Tools For Sustainable Best-Practice Energy Management

Abstract from a white paper presentation

Sustainable development requires long-term resource management coupled with the efficient use of existing assets. To achieve energy sustainability, organisations need to efficiently track energy consumption and be able to audit and analyse the information to identify and implement opportunities for efficiency improvements.

Accurate models and tools to implement best practice processes and systems to facilitate energy management have been developed over the past 16 years in collaboration with corporate and local government organisations, This paper discusses the models and tools, outlining their applicability and discussing the successes and the challenges of implementing enterprise-wide sustainable energy management.

Introduction

Two of the most frequently cited obstacles or barriers to organisations, regardless of size, committing to energy and environmental practices are perceived cost and lack of management time. (Lawrence, S. Dr Collins, E. 2004, Sustainable practices of New Zealand business). However, a number of researchers have demonstrated that the cost of doing nothing is far greater (New Zealand Property Council, Energy costs are the single largest controllable expense for buildings, 2000).

These costs arise from the lack of awareness of how energy is used within an organisation and the total cost of energy consumption. To achieve effective energy management, organisations need to track energy and costs efficiently, and carry out audits to identify opportunities for efficiency gains. Reporting and communicating on the performance of their initiatives is essential to perpetuate and drive successful practices from within. To be sustainable, this process should not be dependent on any particular employee or manager within the organisation. Therefore an effective software tool must ensure that all data is "live", i.e. easily accessible to successive or additional employees.

While the idealistic motivation for implementing a policy of sustainable development is that it not only "meet(s) the needs of today, but does so without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development Report, 1987, p43), in practice, organisations that commit to energy management practices do so for different reasons, including a simple payback in terms of dollars.. However, the benefits associated with efficiency and sustainability come as a bundled package regardless of what motivated them. Even if an organisation's only reason for using energy more efficiently is to save money, there will be, by default, downstream environmental benefits stemming from reduced use of non-renewable resources and reduced CO2 emissions, as well as enhanced public perception of the company as being environmentally responsible.

A basic tenet of energy management is that energy must be able to be measured before it can be managed. A complementary principle is that without knowing what its energy use was in the past, an organisation cannot appreciate where it is today or accurately predict where it could be tomorrow. The energy management tool described in this paper meets both these essential requirements; it measures how much energy is being used and exactly where it is being used, and it enables past, present and future energy use to be quickly and accurately compared and/or predicted.

However, to realise the economic and environmental gains of energy efficiency, management must first commit to investing in smart tools and mechanisms that will enable these gains to be made. A genuine commitment by management in terms of making an economic investment in a sophisticated yet easily operated energy management system, and reinforcing this with training, will be rewarded by a reciprocal 'buy-in' by staff keen to learn new skills and contribute to their company's productivity gains.

Communication throughout the organisation is vital to the programme's success. At the outset staff 'at the coal face' must understand the reasons for implementing an energy management strategy, the goals the company is aiming to achieve, and how each individual and department can help to achieve them. Thorough training is essential for all those who will be inputting or interpreting the data, and there should be frequent and open reporting via internal company communications on the outcomes of the systems implemented, as well as any challenges or barriers that may arise during the process. To summarise, the organisation must commit finance and resources to sustain a long-term programme of energy management.

This paper will introduce a working model and software program that has been fully commercialised in New Zealand to assist organisations manage their sustainable energy management programme.

Energy Management Model

The principal model and methodology that has been created to efficiently and effectively implement sustainable energy management is depicted in Fig.1 through Fig. 3, and in total in Fig. 4. This model when complemented with a tool that automates and enables the micro and macro management functions, bridges the gap between theory and the practice. Such tools, coupled with expertise, enable companies to identify and implement measures that are going to be effective and reduce the risk of 'dead-end' technologies and measures being attempted.

Stage 1 – management audit

The objective of this stage is to establish what is happening now and what are the key things the organisation wants to achieve from a programme of energy management. With the support of the energy management consultancy, all the key stakeholders participate in establishing the current situation, identifying the vision and key goals, and setting timeframes as depicted in Fig.1. The hierarchy of the organisation should be clearly identified at this early stage – that is, how it is

structured, and what is needed to support an ongoing program of energy efficiency. The involvement of the consultancy as a third party enables participants to have constructive input and communication about this process of potential change. Often, this is not easily achieved when the process is managed internally, because agendas, responsibility and familiarity cloud the issues under discussion.

Complementing the engagement activity is the identification of all the information, data and processes that currently enable, or disable, the management of all energy types the organisation uses. The physical and virtual processes that currently exist to verify and facilitate the best practice use of and payment for this resource are identified, as is how or whether the organisation currently identifies opportunities for improvement, efficiency and sustainability. The company's present direction can then be assessed and extrapolated to provide an indication of the costs in resources, time and money of the existing approach to energy management. This reality check for organisations can be a sobering experience.

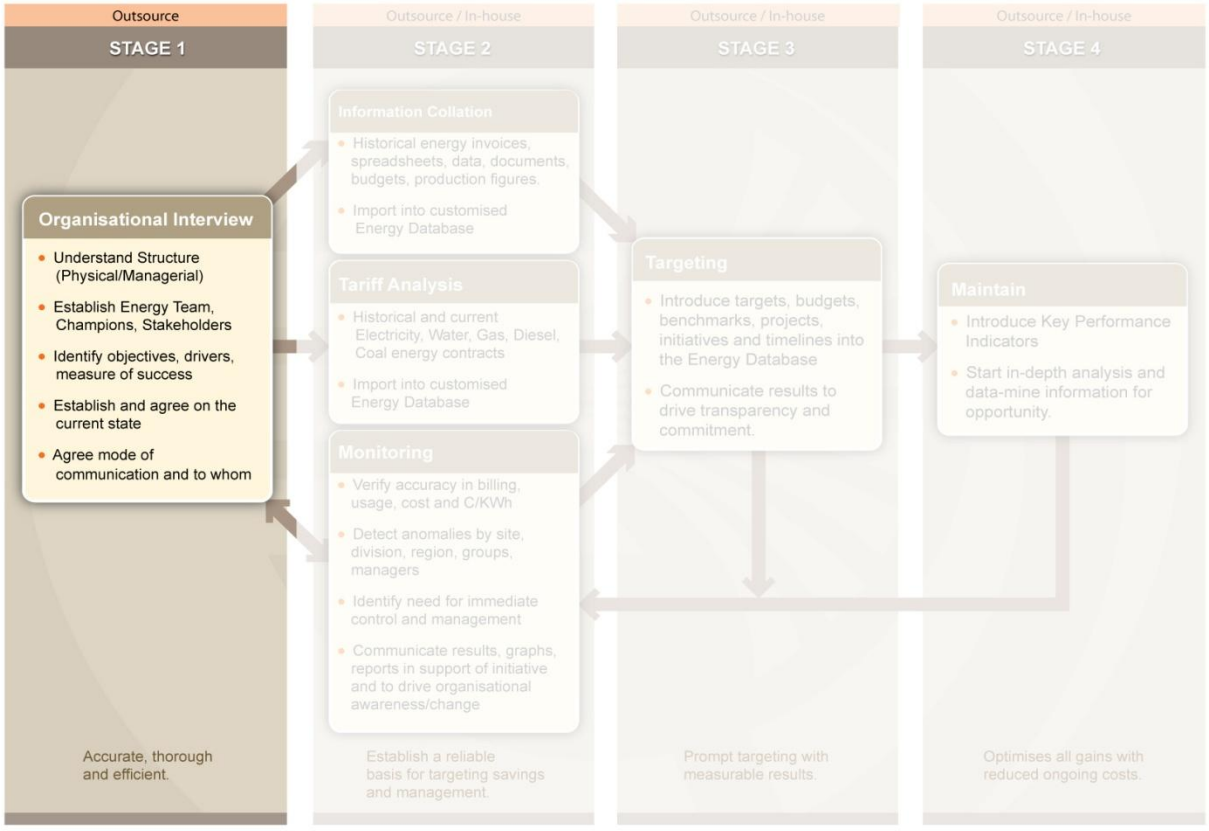

Figure 1. EnergyPro energy management roadmap.

Stage 2 – untangling the clutter

In the New Zealand electricity industry there are five major generation companies and a number of smaller generators. The electricity generated is transmitted over the national transmission grid which is owned and maintained by Transpower New Zealand Limited. Electricity is then distributed with the assistance of electricity retailers to the consumer by twenty eight local lines companies. The entire New Zealand electricity industry is regulated by the Electricity Commission. This complex supply chain and energy comes at a cost that is passed onto the consumer, and this is no more evident than in the varied and complex layout of the energy invoices organisations receive at differing times of every month. Complex though it may be, this information is critical in that it is often the only accurate information that substantiates the history of the organisation's energy usage and cost.

Unfortunately, this is not the only challenge organisations face. The accounts-payable processes and the handling of the historical invoices are often not aligned with specific month-on-month activity, and when the invoices are gathered, the time-consuming manual process required to turn the data into strategic information is either impossible, or simply not sustainable. In addition, the skills required for deciphering the invoices and differentiating variable charges from fixed, energy from non-energy, one invoice from the next, and third party charges and levies on top of it all, either do not exist within an organisation or reside with a collection of different people from different functional areas. From this tangle of invoices, charges and levies, it is all but impossible to sensibly and accurately create base-year targets and information, much less a benchmark for energy usage.

The energy management software tool described in this paper combats these barriers by means of an automated and integrated software platform, customised to use the company's/organisation's own terms for particular functions and for its personnel and corporate structure. The software tool provides entry points for the data required by each functional area, and presents information in forms that mean something to those who use it, e.g. specific, detailed information at an operational level and an overview at a higher (management) level.

Organisations can choose to use the software tool in-house, with the support of staff training given by the consultancy implementing the system. Alternatively, the client can request the consultancy to monitor the software tool's output remotely and provide analysis, reports and advice to the company as required.

Once the information has been identified and then collated, the programme accesses historical energy invoice usage and cost information electronically, importing it directly into the platform for analysis against the agreed supply prices and agreements stipulated within the energy supply contracts. See Fig.2.

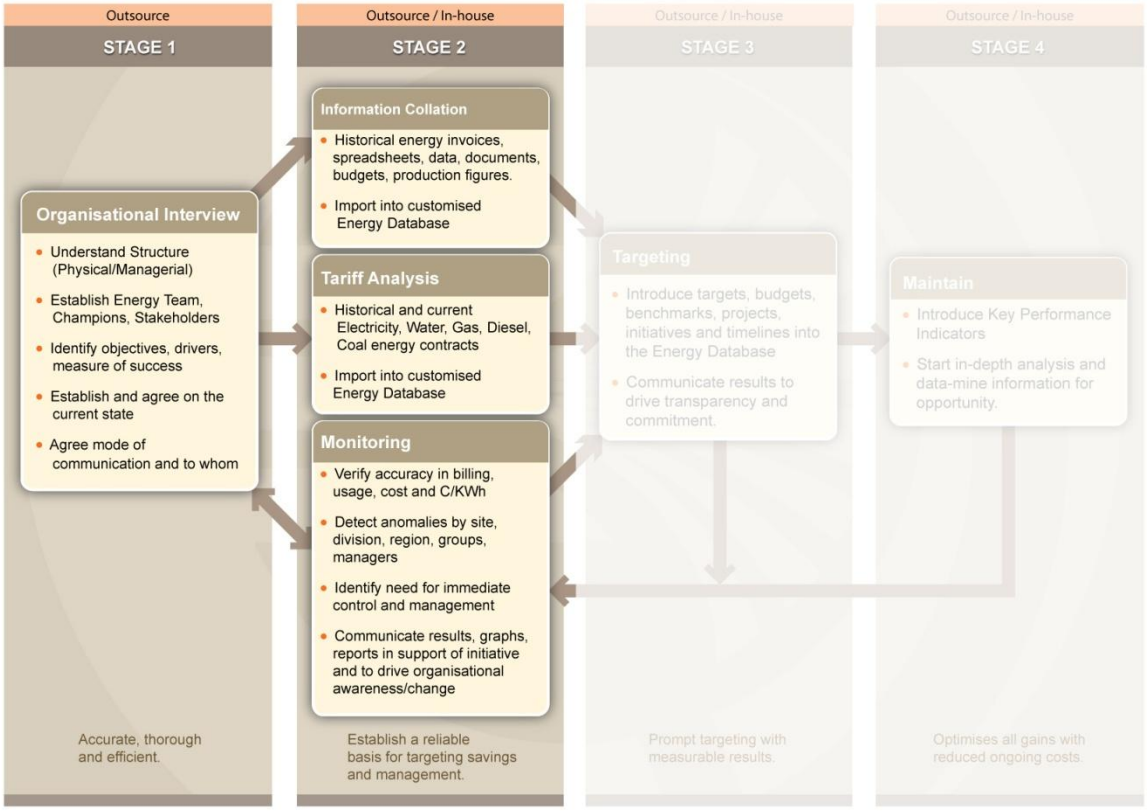

Figure.2. EnergyPro energy management roadmap.

This automation enables organisations to analyse and compare the correctness and trends of historical usage with present day usage and costs, identify areas that require management and control, and immediately deal with errors and anomalies. Frequently, the return on investment is realised within a year, and sometimes, when major errors are identified, immediately upon implementation of the software tool.

The process of both aligning the tool with the organisation, and initially validating and auditing the correctness of the historical to present day usage and costs, creates a database that can be analysed to assess the ongoing energy management strategy.

The user is able to query and trend the entire organisation by any energy or utility usage and/or cost from macro to micro levels across all areas, regions, business units, cost centres, managers, properties and sites with absolute accuracy in seconds. This information can then be graphed, tabled and emailed from within the programme to specific-interest stakeholders.

To summarise, the myth that electricity and utility charges are a fixed cost coupled with the belief that implementing energy management initiatives are costly and prohibitive is simply not correct when it is done with the appropriate tools and expertise. Utilising this software tool allows organisations to inherit immediately years of industry experience, best practice processes, expertise and investment, and thus free up their skilled staff for higher-level activities that take advantage of opportunities for improved energy efficiency.

Stage 3 – flexible application

The software tool presents information that the organisation then interprets so that it can set and prioritise strategies based on the original goals and targets set in Stage 1. Projects and initiatives can be created within this strategy, with implementation timelines based on the organisation's ability to cope with and resource change. These projects can be monitored and tracked, and their successes communicated to the workforce to encourage a culture of responsibility and change that further enhances the gains.

Using the tool to track energy use enables an organisation to assess its productivity in a number of different permutations. For example, a widget manufacturer may decide to track production as 'number of widgets produced per KWh', or 'number produced per dollar of energy used'. Or, if 50 machines are all doing the same widget-producing job, discovering that one machine is using too much energy to make widgets cost-effectively will enable the company to modify the machine or scrap it. The 'widget', of course, can represent anything from a tangible product to a service; the essential point is that the energy used to produce the widget can be accurately monitored so that the company can compare its cost of production with accepted industry or international benchmarks, or against its own internal benchmarks as shown in Fig.3.

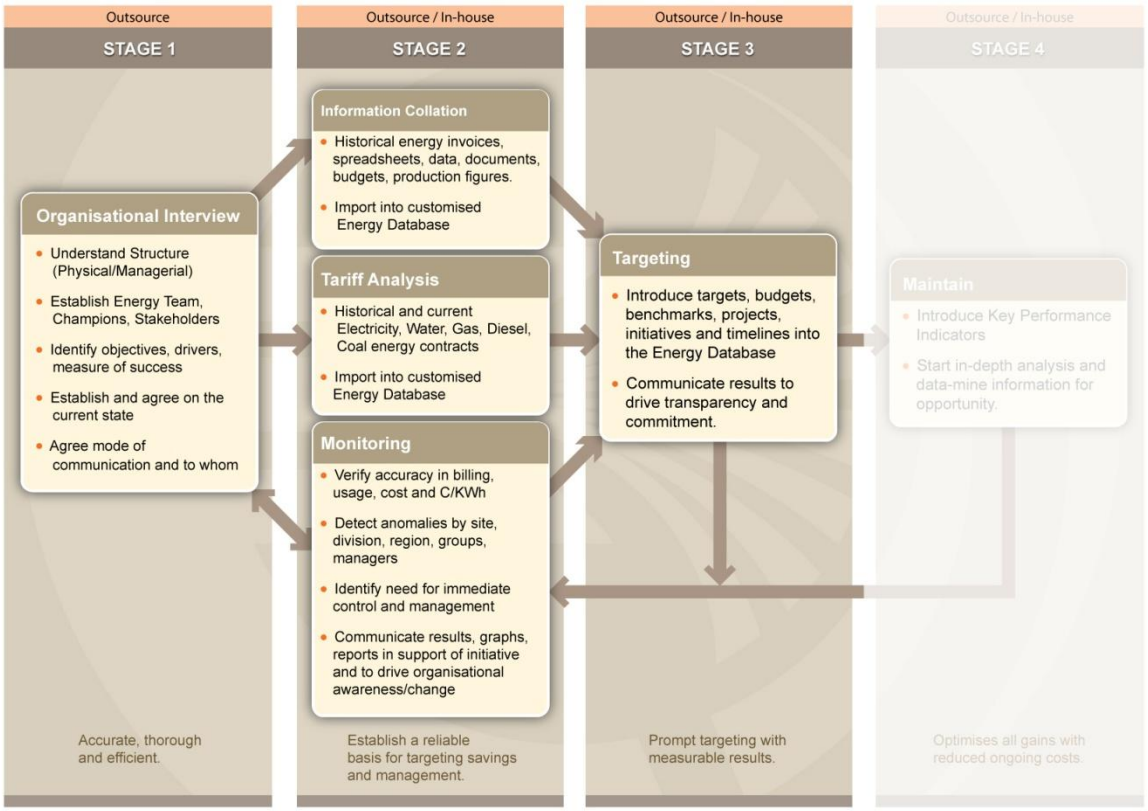

Figure 3. EnergyPro energy management roadmap.

Targeting is an ongoing process of continuous improvement which, once established, allows new threads of information to be introduced and analysed: for example, 'energy used per square

metre of plant', or 'per $x worth of plant/assets', or 'for activity A compared with activity B'. The software program facilitates the examination of a huge number of such production variables, enabling the energy manager or the outside consultant to easily identify inefficiencies and energy waste.

Stage 4 – refining and enhancing the program

Once an organisation has a database that presents previously inaccessible information specific to its requirements, it is relatively simple to maintain momentum for energy management. In addition, opportunities for further refining and enhancing the program's outputs and reporting can be identified and developed. These can include key performance indicators in support of other internal and external initiatives, such as monitoring CO_2 emissions to comply with targets or regulations. See Fig.4.

Once energy budgeting, purchasing and cost management processes are integrated within the software tool, the organisation has a truly embedded best-practice model, which not only supports sustainable management with enhanced effectiveness, but also produces economic benefits that will continue to fuel the whole program.

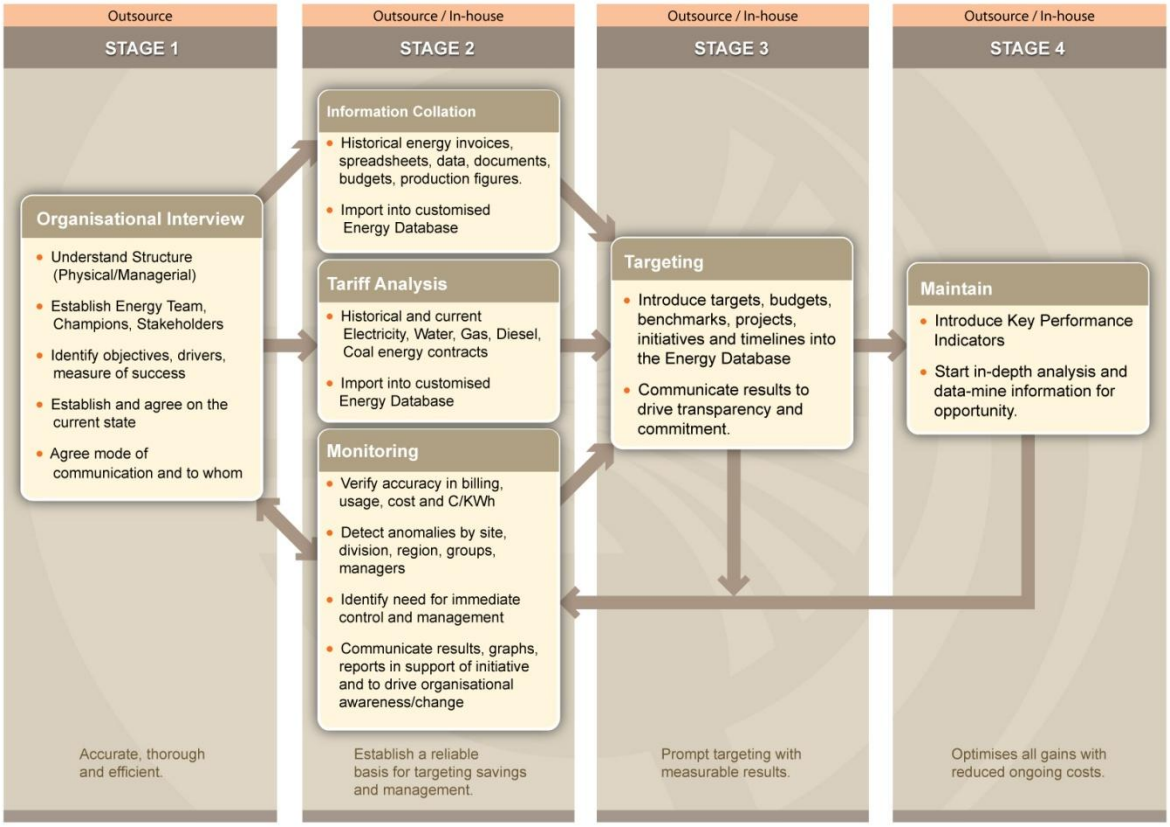

Figure 4. EnergyPro energy management roadmap solution.

Energy management successes and the challenges

Over the past 16 years, this energy management tool and the services that support it, has saved 36 clients a total of $28 million in energy costs, and 313,125,476 KWh. These include:

A company with 185 nationwide sites saved a rolling $1.5 million a year as a result of the outsourcing their data management, monitoring and targeting, analysis and enterprise wide functional reporting. The senior management of this company launched an energy policy with a target of 10% annual energy saving, the organisation established an Energy Efficiency Action Group and distributed energy saving instructions and a promotional 'energy smart' video. The importance of energy benchmarking, monitoring, analysis and reporting was realised and attempted with the incumbent service providers, internal resources and spreadsheets. This was not successful or sustainable and inhibited the energy management programme. Applying the model and tools discussed in this paper, senior management were able use the software to communicate efficiently and provide the resource and transparency required for specific business groups, brand managers, area managers and individual site managers to support the energy policy.

All the available energy information when analysed was outdated and limited to the most recent energy purchase contract, the companies benchmarks were based on this data and therefore found to be inaccurate . A process to track enterprise wide energy use and cost did not exist, historical energy invoices were not easily referenced due to internal administrative practices. The software tool has an electronic data interface capability which allowed for the transfer of invoice data from the energy retailers billing system. Stage two of untangling the clutter, establishing base year targets, providing enterprise-wide reporting, energy consumption and cost transparency, and a tool to allow detailed analysis and auditing was achieved in 7 weeks. Energy was then part of the facilities management report to the board, this introduced fact based management, a focus on individual success, compliance and raised the profile of energy conservation. Immediate savings opportunities across the organisation were identified with an initial energy saving of 282,500 KWh per annum, and $300 thousand in energy costs.

The software identified inaccuracies in previous energy targets of -16% to +52%, energy billing errors were identified and due to inaccurate energy rates, metering, line charges and energy inefficiency saved $472,000 per annum.

Following the same methodology, a national retailer with 100 sites used the program to approve more than 100 electricity invoices within days of receiving them, while at the same time flagging anomalies so that they can be remedied quickly. Previously this required 4 administrative staff and several weeks to complete with no ability to identify opportunities. Based on historical energy use information, the company could be spending $5.5 million a year on energy; instead it spent $3 million a year – saving the equivalent of the annual profit of one of its larger stores. With the program it was established that on average the site energy use was reduced from 200 KWh/m2/year to 105 KWh/m2/year. An independent case study on these findings was published. (Energy Efficiency and Conservation Authority New Zealand, Energy monitoring and targeting generates "money back, guaranteed", April 2003).

Again, following the same methodology, a large District Health Board used the program to reduce annual energy-budgeting time from days to a couple of hours. A New Zealand City Council lost their Energy Manager after four years of service. The energy management program continued with support from the provider with no loss of momentum, as the database is the historian and integral in automating communication and analysis in support of the City Councils energy management.

Conclusion

These are examples of sustainable energy management achieved by installing a program that will continue to offer benefits long beyond implementation. Leadership, culture and organisational structures will all change over time. However an investment in technology and automation to monitor and manage energy will continue providing much-needed information and analysis to substantiate and support informed and environmentally smart decisions.

The models and tools described in this paper can be used by all central and local body Government departments, and large multiple site corporate organisations. As the findings above describe, the software tool automates and allows the analysis of all energy and related information accurately and quickly communicating the results according to the organisation and individual focus. Organisations use the software to improve energy procurement decisions, audit and validate all electricity and utility usage and cost, improve budgeting and accrual, identification of anomalies, plant maintenance requirements and to monitor the results of projects and initiatives.

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