

Case Study

e3 Energy Management Bureau

INTRODUCTION

Four Dublin-based colleges, Dublin Institute of Technology (DIT), Trinity College Dublin (TCD), Dublin City University (DCU) and University College Dublin (UCD), joined together to form an energy management bureau e3 (Energy – Environment –Economy).

An Energy Management Bureau:

- › analyses energy consumption
- › identifies opportunities for savings
- › implements change

e3 was formed for two main reasons - to save money and to help reduce CO₂ emissions. Working together with a common focus, the colleges shared system setup costs and learnt from one another. Each institution has different requirements, but the collective effort of e3, aided by a Bureau Service Provider, has succeeded in identifying and adopting best practice in energy management.

Project Background

The e3 project was part-funded by Sustainable Energy Ireland, to facilitate the Bureau service and the upgrade of the existing energy monitoring systems.

At the outset, e3 identified two necessary components of the project:

- › implementation of an Energy Monitoring and Targeting (M&T) system
- › appointment of a Bureau Service Provider (BSP) to provide organisation and technical expertise

The Energy M&T system was required to track the electricity and gas usage of each building. A monitoring system had already been developed by UCD's Energy Unit using their existing Cylon Building Management System (BMS), spreadsheets and a web-server. Similar BMS systems were in place at TCD and DCU and these were modified to monitor energy consumption in their respective buildings via a M&T website. There was also a monitoring system in place at local-level in the DIT buildings and this was web-enabled.



“At D.I.T. the experience of the participation in the e3 Bureau has helped us learn from other colleges through innovation and cost saving exercises. Management and staff have accepted an energy policy, and this increased participation has heightened the profile of energy management.” Richard Smith, Dublin Institute of Technology

e3 appointed White Young Green Ireland in partnership with PowerTherm Solutions as the Bureau Service Provider, for the initial project timeframe of 2003 – 2006. The team has been reappointed as BSP, as e3 continues to develop the bureau.

ENERGY SAVINGS GOAL

e3 identified a target of reducing the Total Primary Energy Requirement (TPER) in 30 key buildings by 3%, 6% and 10% at the end of 2004, 2005 and 2006 respectively. Each college put forward its own buildings, generally chosen for the project because of high energy spend. The age range of the buildings varied from 20 to over 100 years.

The target was seen as ambitious in light of the fact that energy consumption in some of these buildings was increasing due to research activities, increasing usage of computers and IT infrastructure, extending opening hours, and a tendency toward the use of air conditioning. Hence the task was twofold: first, to halt the rise in energy consumption; and second, to focus on reversing the trend.

An energy goal was selected to allow conversion into financial and environmental savings, parameters which all involved could easily relate to. *Primary* energy was selected to reflect greater greenhouse gas emissions and cost associated with electricity use rather than gas use.

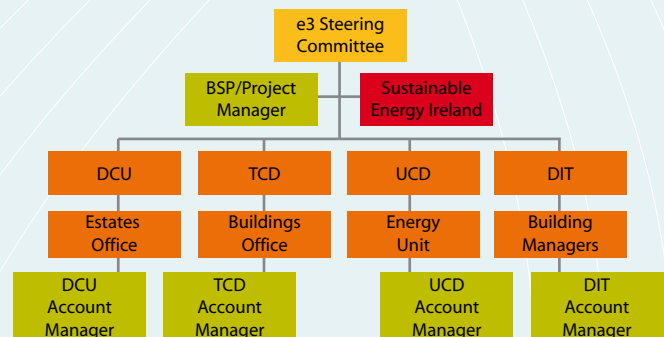
How e3 works...the Energy Management Strategy

With the above goal in mind, the next step was to identify an energy management strategy to deliver the 10% target savings. The strategy had three basic components:

- an **organisational structure** to coordinate and manage e3 but which would also work within the existing college structures

- **activities** to identify measures to deliver the savings, monitor progress and implement change
- **awareness programmes** to promote an energy efficient culture at each college

e3 Organisational Structure

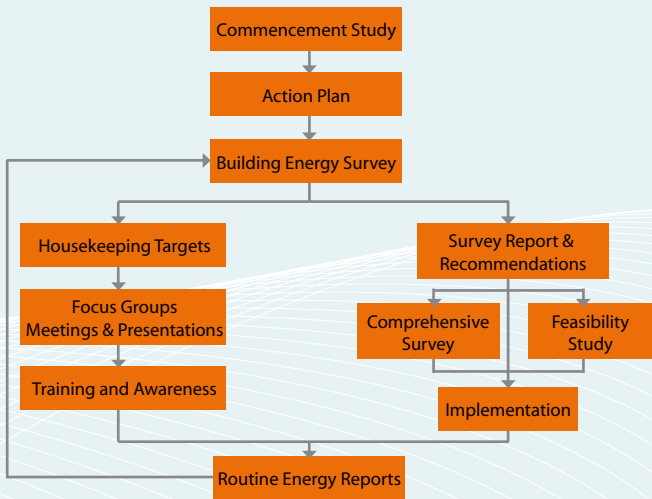


The **Steering Committee** consists of a representative from each of the four colleges, SEI and the BSP. It sets the overall direction of e3, and meets every 4-6 weeks.

The **Project Manager**, a representative from the BSP, is responsible for the overall organisation of e3. This includes arranging steering committee meetings, quality control, guidance for the account managers and management of the website, www.e3.ie.

Each college is assigned an **Account Manager** by the BSP with responsibility for carrying out the relevant routine and commissioned services at that college, and for ensuring progress. However, it is the colleges that maintain control and guide the activities of the bureau, and benefit from the shared experience of the challenges of effective energy management.

e3 Activities



In order to establish baseline energy consumption in each building a project commencement study was undertaken. This was followed by an action plan which determined a structured approach to carrying out the annual services at each college.

Each building had a concise energy survey in year 1 to identify 'quick-win' opportunities for energy saving measures in relation to house keeping and building plant. Depending on the size of the building, the concise survey involved a night visit and a weekend visit and took about 3 days per building.

In year 2, an Electrical Base-Load Analysis was undertaken for each building to identify and quantify the night-time electricity consumption. In Year 3, certain buildings in which substantial energy savings could be achieved were selected for project feasibility studies.

Technical reports were produced following each survey which included a list of energy-saving measures recommended. The BSP met with each college to discuss the content of each report and agree upon a list of actions which would be earmarked for implementation. Prior to implementing these measures, further feasibility studies or comprehensive surveys were sometimes required.

e3 Awareness

The findings of the year 1 surveys were presented to the staff working in each building. These presentations highlighted what staff could do to reduce energy consumption. The messages from these presentations were then reinforced by the circulation of stickers, posters and reminder notes to raise awareness of e3 amongst staff and students.

In anticipation of the forthcoming Energy Performance in Buildings Directive requirement that all public buildings over 1,000m² display their energy rating in a prominent place, e3 produced its own Building Energy Ratings posters for each of the buildings in year 3 and assigned a rating based upon its normalised annual energy usage (kWh/year/m²). These ratings were updated at regular intervals to reflect improvements in building energy performance.

Information packs were produced to advise people on how to select, control and operate air-conditioning units as efficiently as possible.

The e3 website (www.e3.ie) provides general information on the project, has links to each college's M&T system, a members' extranet where all project documents are stored, latest news as well as downloadable training and awareness material.

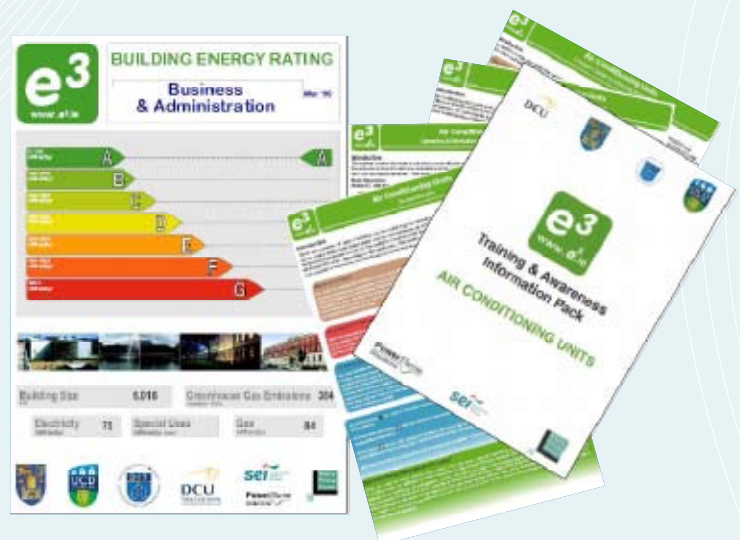
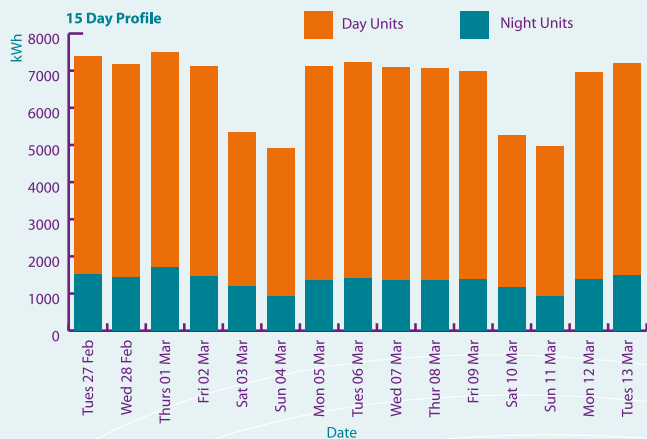


Figure 1: Sample output from Energy Monitoring System

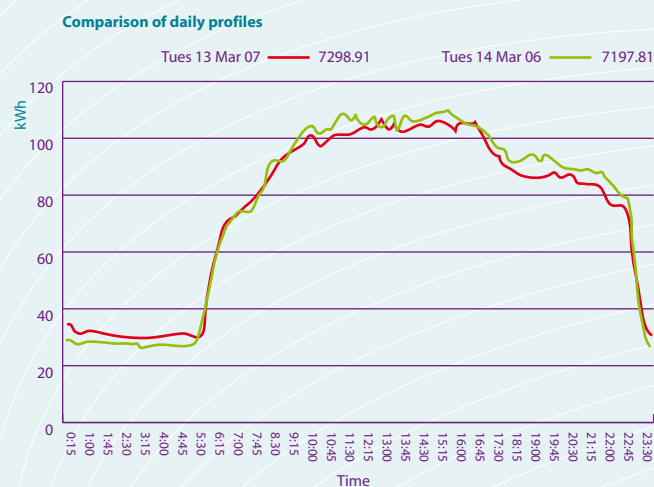


Energy Monitoring

The Monitoring and Targeting (M&T) system monitors electricity and gas consumption for each building at 15-minute intervals. These real-time energy figures provide a means for staff to monitor the impact their activities had on the overall electricity load in the building.

The information from the M&T is also used for analysis in the routine building, monthly and annual reports and as such is the primary tool for evaluating progress. Data from the M&T highlighted anomalies such as irregular electricity or gas consumption outside building occupancy hours.

Figure 2: Report Of Energy Usage from Energy Monitoring and Targeting System



Energy Saving Solutions

One project showed that an auxiliary boiler installed for an Air Handling Unit (AHU) that served an animal housing facility paid for itself within 2 months. The area in question required heating and ventilation on a 24/7 basis. Previously the main boilers in the building had to operate overnight and throughout the weekends to provide hot water to the AHU. Six months after its completion, the project had saved in excess of 30 tonnes of CO₂ emissions and over €22,000 in gas costs. This project was replicated in a similar building in another college.

In libraries it was found that the wide variation in occupancy patterns over the course of a day and year meant there was potential to reduce fan speed and ventilation rates depending on occupancy. Variable speed drives were installed on an AHU serving one library. The temperature and CO₂ levels (a proxy for occupancy) in the extracted air were used to regulate the volume of supply air required. This project had a payback of 5 months and saved 30 tonnes of CO₂ emissions and over €7,000 in annual electricity and gas costs.



“Participation in the e3 Bureau has allowed UCD to adopt a structured approach to energy management. The e3 brand has been very effective in raising energy awareness within the University and the sharing of ideas and experience among the four Colleges has significant benefits.” Donal McGowan, University College Dublin

Energy Procurement

The annual procurement of electricity and gas for each college was key to achieving significant cost savings. In this case, the BSP negotiated on behalf of the four e3 colleges, and the option of joint purchasing agreements placed the colleges in a favourable position.

Each year, the most favourable electricity contracts were sourced, and where possible purchased from green energy suppliers such as Airtricity. A joint purchase agreement was signed with Vayu in mid 2005 which fixed gas prices for the following three years. This agreement provided budget certainty for the colleges during a period of volatility in the markets and seemingly ever-increasing gas prices.

Electricity procurement alone saved the colleges over €420,000 during the three years of phase 1. A contract signed late in 2006 with Airtricity for the supply of renewable electricity will yield savings of over €800,000 for the e3 colleges during 2007.

Key Learning Outcomes of Energy Management

Energy strategy must be customised to suit organisational structure and culture. Services were modified to suit local needs - where building management was devolved the colleges wanted regular individual building energy reports; where building management was central, a single overall monthly report was preferred.

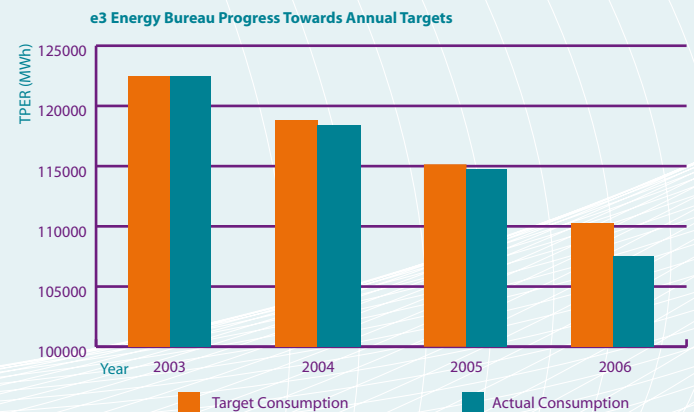
Influencing key individuals has greater impact than general awareness campaigns. Influencing building occupants in each college was difficult to do given the large numbers of staff

working in the buildings, and the transient nature of students and cleaners. So, focus switched to influencing key individuals – such as building managers and building services staff - who could make an impact on the energy consumption in each building.

Automation-based savings such as lighting controls & BMS strategies are more effective than influencing user behaviour on housekeeping items, i.e. habits such as leaving lights and computers on overnight.

Achievements

e3 achieved a 12% reduction in energy use, exceeding its original target. It is now expected that these savings will continue to accrue in future years with limited further investment of resources.



"At DCU we believe in innovation. Participation in the e3 Bureau has focused the need to manage our energy usage more efficiently.

The e3 Bureau has successfully encouraged each faculty to become more involved in energy management.

This responsibility has been embraced by all at DCU and the support of the bureau through the collective experiences of the four colleges has been central to our success."

David Faherty, Dublin City University

"The e3 project has provided a great opportunity for Trinity College to set up a formal process to reduce energy consumption within the College. The shared experience of the service provider and members of the bureau is an invaluable source of information which helps us manage our buildings in the most energy efficient manner." Kieron McGovern, Trinity College Dublin



The table below illustrates how cost savings grew from €158,000 in 2004 to €643,000 in 2006. The cost of the service exceeded the savings in the first year, but paid for itself in subsequent years. In the third year, reductions in energy use alone were more than double the cost of the service. These savings will continue to accrue in the future at relatively low cost. Energy use must continue to be monitored and managed, but only where an upward trend emerges will external intervention be required to identify and resolve the issues.

	2004	2005	2006	Total
Target Energy Reduction	-3.0%	-6.0%	-10.0%	-10.0%
Energy Reduction Achieved	-3.3%	-6.2%	-12.2%	-12.2%
Demand Management				
Energy Savings (MWh)	4,041	7,715	14,939	26,695
Carbon Savings (Tonnes CO ₂)	1,214	1,739	3,282	6,235
Cost Savings (Euro)	€158,000	€258,000	€643,000	€1,059,000
Electricity Procurement				
Cost Savings (Euro)	-	€168,000	€252,000	€420,000
Cost of Service	< €300,000	< €300,000	< €300,000	< €900,000

e3 has surpassed the original 10% goal with the successful achievement of a 12% reduction in energy use in 30 buildings, representing savings of over €1.4million and a reduction in emissions of 6,200 tonnes of CO₂. The total cost of the bureau service was less than €0.7million, excluding the cost of investment projects to reduce energy use. It is expected that annual savings in the order of €1million will continue to accrue in the future; sustaining these savings will require basic levels of energy monitoring and management, with occasional interventions where a building's energy use starts to rise.

These savings were achieved against a backdrop of rising overall energy use associated with increased research activity, longer opening hours, additional computers and IT infrastructure, and a tendency toward air conditioning.

Building on this initial success, the e3 project has been extended to run for a further three years until the end of 2009. 35 additional buildings have been added to the original buildings from phase 1. The goal is to reduce the energy consumption of the new buildings by 10% by the end of 2009, whilst maintaining and improving upon the savings already achieved.