

Global Energy Management System Implementation: Case Study

Ireland

Dublin City University

Energy Management through Foresight



Dublin City University

Business Case for Energy Management

DCU is a young, ambitious and dynamic university; since admitting our first students in 1980, we now deliver more than 250 programmes to over 17,000 students across 5 campuses. Our excellence is recognized internationally being consistently ranked among the top 50 'under 50' universities in the world and 15th in the recent GreenMetric Worls University Rankings.

DCU first adopted a structured approach to energy management in 2004 when it established the e³ energy management bureau with 3 other Dublin-based colleges, with the target of achieving a 10% energy saving in selected buildings 3 years. The roots of this initiative, ahead of its time, were energy, environment, and economy (hence "e³"). This involved metering and monitoring energy use by each building, periodic energy audits, energy awareness, BMS optimisation, and

energy projects; monthly and annual reports tracked progress.

"Incorporation was the ideal time to implement ISO 50001; it enabled us to replicate the success of our energy management system in Glasnevin across all of our new campuses" Richard Kelly, Estates Manager

Case Study Snapshot

Industry	Education
Product/Service	Education
Location	Dublin, Ireland
Energy Management System	ISO 50001
Energy Performance Improvement Period	11 Years
Energy Performance Improvement (%) over improvement period	32%
Total Energy Cost Savings over improvement period	US\$ 10 million
Cost to implement EnMS	US\$ 50,000
Payback period (years) on EnMS implementation	Less than 1 year
Total Energy Savings over improvement period	500,000 GJ
Total CO₂-e Emission reduction over improvement period	50,000 metric tons

Ireland's National Energy Efficiency Action Plan has set an ambitious national public sector target of a 33% energy performance improvement by 2020. Anticipating the challenge ahead, DCU expanded its e³ energy

management system to include all buildings and challenged design teams to deliver high efficiency buildings and its facilities management to drive energy performance throughout all operations.

As a forward thinking university, DCU's Strategic Plan *'Transforming Lives & Societies' 2012-2017* stated **"Campus Developments will embrace principles of environmental sustainability and we will set ambitious targets in terms of energy efficiency"**. The public sector 33% target became DCU's formal internal target and DCU Estates issued its first formal Annual Energy Review in 2013, setting out its progress to date and plans for the coming year. It followed the publication of the Estates Office Energy Strategic Plan in 2011, *"Towards Integration & Sustainability"*.

When DCU announced its Incorporation with St. Patrick's Drumcondra, Mater Dei and the Church of Ireland Centre for Education, in 2015, involving plans to expand from one campus to five campuses over three years it became apparent that bringing its existing energy management practices to the new campuses could be best achieved by standardising and structuring energy management. Adopting ISO 50001 was the only way to achieve this. In 2016 DCU participated in the ISO50001 Master-class run by the Sustainable Energy Authority of Ireland, and through that process redeveloped its energy management system to meet ISO50001 requirements. By 2017 we had succeeded in implementing our energy management system in the new and existing campuses, and also secured ISO50001 certification.

Business Benefits Achieved

DCU spent €3.8 million / US\$4.7 million on energy in 2016. This included the cumulative spend across the campuses prior to incorporation and prior to the purchase of the All Hallows Campus.

The benefits to DCU from adopting the specific structured approach to energy management and achieving ISO50001 Certification include:

- Energy performance improvement of 32%.

- Annual energy savings of 37,000 GWh in electricity, 44,000 GWh in gas.
- Annual energy cost savings of €1,663,000/ US\$ 2,045,000.
- Reduction in CO₂ (greenhouse gas) emissions of 8,000 tonnes per year.

Other, non-quantitative, benefits include:

- ISO50001 Certification provides 3rd party proof that energy management is something we really do, not something we simply talk about.
- It enhances the environmental reputation of DCU to the people that really matter: our current and prospective students, our staff, and our community.
- By formalizing and documenting our energy management systems, in a comprehensive energy management manual, the system can be communicated to new staff and facilities contractors at the new campuses, it's an invaluable management tool.
- Progress toward DCU's and the public sector's goal of a 33% energy performance improvement by 2020; and positioning DCU well to achieve its 2030 goal.
- It simply makes all of our jobs easier.



EnMS Development and Implementation

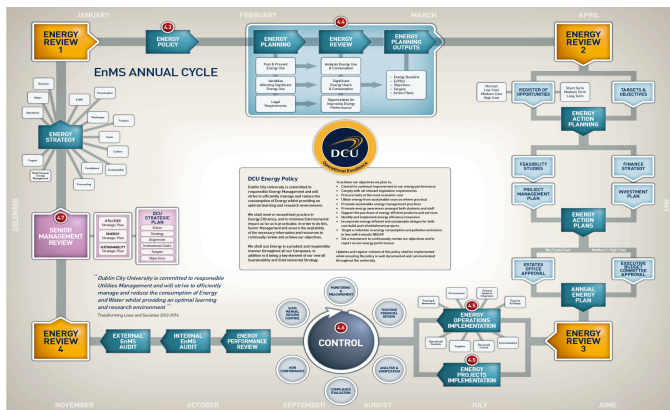
DCU first adopted a structured approach to energy management in 2004 when it established the e³ energy management bureau with the target of achieving a 10% energy saving in selected buildings 3 years. This grew to the inclusion of the entire campus. With Incorporation and the purchase of All Hallows DCU decided to formalize its Energy Management System to help integrate best practice energy management across its existing and new building stock and resources. Over a two year period, between 2015 and 2017 DCU redeveloped its existing energy management system to meet ISO50001 requirements.

Organisational

DCU have been managing energy since 2004 with energy management initially seen as primarily an Estates Office activity. To achieve ISO50001 certification we developed an integrative Energy Policy and, once signed by the President, DCU became formally committed at the highest level. The Chief Operating Officer is the senior manager responsible for energy management throughout the organisation, the Head of Estates was appointed Energy Performance Officer (under the Irish Public Sector Energy Efficiency Strategy, all Public Bodies must designate an Energy Performance Officer), and an Estates Office Energy Management Team was formally set up.

Energy Review and Planning

DCU’s annual energy management planning cycle is illustrated below. It incorporates the essence of ISO50001 but is specifically customized for DCU Operations.



DCU Energy Management System Annual Cycle

DCU Estates Office issued its first Annual Energy Review for 2013, 4 years prior to certification. The energy baseline was the average energy over the period 2001-2005, which reflects the period when we began managing energy in a structured way and ensures that the benefit of DCU’s early efforts were captured.

When we evaluated possible Energy Performance Indicators we concluded that although an EPI of energy use per square meter would account for the physical growth of the campus, this simple EPI did not

adequately reflect the actual growth of DCU. Effectively, DCU had transitioned during the same period from a 3rd level, largely educational university to a 4th level applied research university with a number of new highly-serviced energy-intensive buildings housing world renowned researchers. To address this challenge, DCU and the other e³ colleges developed a relevant variable called ‘Research equivalent floor area’, which includes the calculation of an adjustment factor for new research buildings that are particularly energy intensive. DCU’s organizational EPI is now energy use per square meter of research equivalent floor area. This has since been adopted by a number of other institutions.

DCU was confronted with the challenge of selecting a manageable number of Significant Energy Users (SEUs); past practice had been to monitor and manage energy use of individual buildings, but this would be unwieldy for 75 buildings and 5 campuses. It was agreed that the new campuses, would each become an SEU and on the original campus buildings with similar activities would be clustered into a single SEU, i.e. Research Buildings SEU 1, Education Buildings SEU 2, Support Buildings SEU, and Residences SEU 4.

Cost-benefit analysis

Costs: Internal staff costs associated with establishing the system are estimated at €20,000. There were no staff training costs, as participation in the SEAI Masterclass was free; some external support was also provided at no cost by SEAI. External costs including SEU energy analyses, assistance in setting up monthly energy reports for checking and monitoring energy performance, and certification-related costs were €25,000. Total cost €45,000 / US\$60,000.

Savings: Energy savings were €1,663,000 / US\$2,045,000 in 2016. These savings are based on cumulative primary energy savings over 11 years of structured energy management relative to what we would have spent if we had a “do nothing” approach.

Payback: Less than 1 year.

Financing

As a rapidly growing university, there are many demands on our budget and diverting resources into long term energy management practices and projects is never easy. Many energy projects are also maintenance/replacement projects, e.g. as boilers reach end of life, installing condensing boilers with advanced controls makes sense, similarly with lighting. The success in DCU comes from the fact that we have an integrated facilities team where Projects, Facilities and Energy Teams work closely everyday to ensure that we are all aware of planned maintenance and replacements. This close alignment allows DCU to utilize co-ordinated budgeting to carry out planned replacement maintenance benefiting in very good energy saving impact.

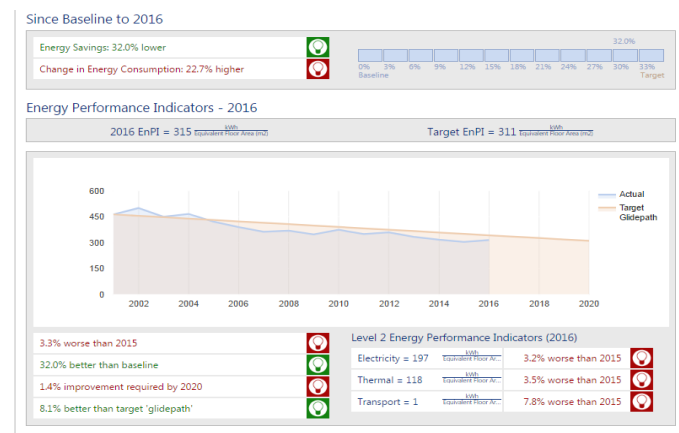
DCU has supplemented its budget for energy projects by participating in various *Sustainable Energy Authority of Ireland (SEAI)* grant schemes, most recently the Better Energy Communities. We have also worked with energy suppliers, who are required to achieve energy efficiency credits under the national *Energy Efficiency Obligation Scheme, (EEOS)*, to support us in identifying and delivering energy projects. DCU is one of very few public bodies utilizing this valuable resource. It has also enable DCU to help fund projects in the Community, most recently with fuel poor housing in our locality. It is hoped that in the future, the value of energy savings can be ring-fenced for re-investment in energy related projects and discussions with our counterparts in Finance are ongoing. In 2017 DCU achieved € 350,000 in grant funding.

“In addition to the recent renewal of our Green Flag status, and news we have achieved ISO 50001 certification for efficient energy management, this success is clear evidence of our progress to place sustainability at the core of DCU”

—Prof Brian MacCraith, President DCU

Approach used to determine whether Energy performance has improved

DCU’s overall energy performance is monitored using SEAI’s Monitoring & Reporting system, which was developed to track the progress of individual public sector organisation’s toward their target 33% energy performance improvement by 2020. The system gathers electricity and gas data from the respective utility meter system operators; relevant variables and other energy data is submitted by DCU via a web user interface. Energy performance improvements relative to DCU’s ‘target glidepath’ are illustrated below.

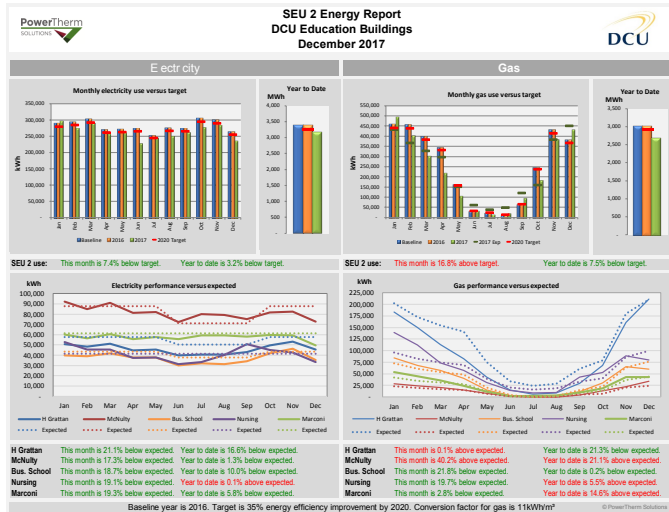


This system provides an annual overall measure of DCU’s performance improvement, which is independently audited. DCU currently stand at 32.1% towards the 33% Target. Without incorporation DCU would be ahead of its targets.

Approach used to validate results

In order to check energy performance on a regular basis and identify significant deviations from expected energy use, monthly Energy Reports (illustrated below) are produced for each SEU. These provide an analysis of overall SEU electricity and gas use, as well as actual versus expected use charts for each building in the SEU. The relationship between energy use and independent variables – such as Heating Degree Days and term-related factors - is established by analysis during the Energy Review; these independent variables are used to calculate expected energy use (e.g. based on the weather last week, and the known relationship between weather and energy use in this building, we can calculate expected energy use). The monthly reports

illustrate actual energy use versus expected use; significant deviations are identified and discussed at a monthly Energy Management Team meeting.



Other considerations are also discussed, such as works that may increase energy use in a particular building, or an energy project that was expected to reduce energy use, together with possible non conformances, updated action plans and initiatives that may have come from staff or students across the campuses.

Energy savings associated with the implementation of Energy Conservation Measures (ECM) are identified in the Annual Action Plan. Once the ECM is implemented, energy savings are verified. In many cases the energy savings are Measured and Verified by an external professional in order to capture the energy saving credits under the Energy Efficiency Obligation Scheme – a scheme whereby energy utilities support ECMs in return for the carbon credits associated with their implementation.

Prior to its certification audit, SEAI supplied an external consultant to do a Gap Analysis. Subsequently DCU had an external consultant complete an audit. DCU and Dublin Institute of Technology (an e3 partner) complete audits of each other’s systems on a twice-yearly basis. This is both cost-effective and informative.

Steps taken to maintain operational control and sustain energy performance improvement

The expansion of DCU to five campuses brought with it the requirement to document and standardize our energy management systems – ISO50001 provided the perfect framework for this.

The energy management system manual describes how DCU manages energy. A number of Standard Operating Procedures were developed to provide further detail on specific aspects including Utility Bill Management, Annual Energy Planning, Annual Energy Performance Review, Managing Projects & Retrofits, and Roles and Responsibilities. These same policies are implemented on all campuses.

All EnMS documents and records are accessible via the DCU Apps Google Drive. Everybody has access. The DCU Energy Manual also encompasses the standardized approach to energy management and is reflected in all projects, facilities and operational teams. The Energy manual is a document that is reflective of everything that the estates Team strive for in DCU.

The Building Management System (BMS) is the principal means of control of the SEUs and their energy use; it also provides the platform for the *Active Energy* monitoring system. DCU developed BMS Operational Control Guidelines to ensure the efficient operation of SEUs via the BMS, and BMS Control Guidelines for ensuring new BMS control strategies are efficient. These guidelines are communicated to the FMs, Project Managers, Design Consultants and other relevant personnel, including our maintenance contractors.

Design Guides are produced for all Building Projects with EXEED (Energy Efficient Design) implemented at all stages.

Development and use of professional expertise, Training & Communications

In order to develop staff competence sufficiently to establish an Energy Management System, we participated in SEAI’s ISO 50001 Masterclass programme. This involved 10 days of off-site training over 12 months. SEAI also provided a partnership consultant to provide guidance on the practical implementation of ISO50001 at DCU.

