

**Energy Bureau for Groups of Commercial
and Institutional Buildings:
Údarás na Gaeltachta Case Study**

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Údarás na Gaeltachta

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Introduction: The Energy Management Challenge for Owners of Many Buildings

Energy costs in most buildings are escalating year-on-year. Owners are keen to reduce these costs. This paper describes the Energy Bureau that has been established by Údarás na Gaeltachta to reduce energy consumption in a widely dispersed stock of commercial, institutional and industrial buildings.

The innovative approach described here overcomes the key problems of energy management in a large stock of buildings. These problems are:

- How do you get energy expertise and technical support to the sites at modest cost?
- How do you achieve energy savings quickly?
- How do you help managers who are consumed with critical day-to-day business issues to support efforts to reduce energy cost at the sites?
- After an initial active phase, how do you maintain staff enthusiasm about energy savings?
- How do you prevent your energy management programme losing direction over time?
- How do you continue to reduce energy consumption and cost, year after year?

It is often the case that energy cost reduction efforts do not consistently succeed in the medium and long term. This is illustrated in Figure 1. Sometimes, the management or owners of buildings will raise urgent concerns about energy costs. This can lead to reductions of energy in the short term, but, when management focus returns to other issues more directly related to the main mission of the business, energy consumption normally returns toward previous levels.

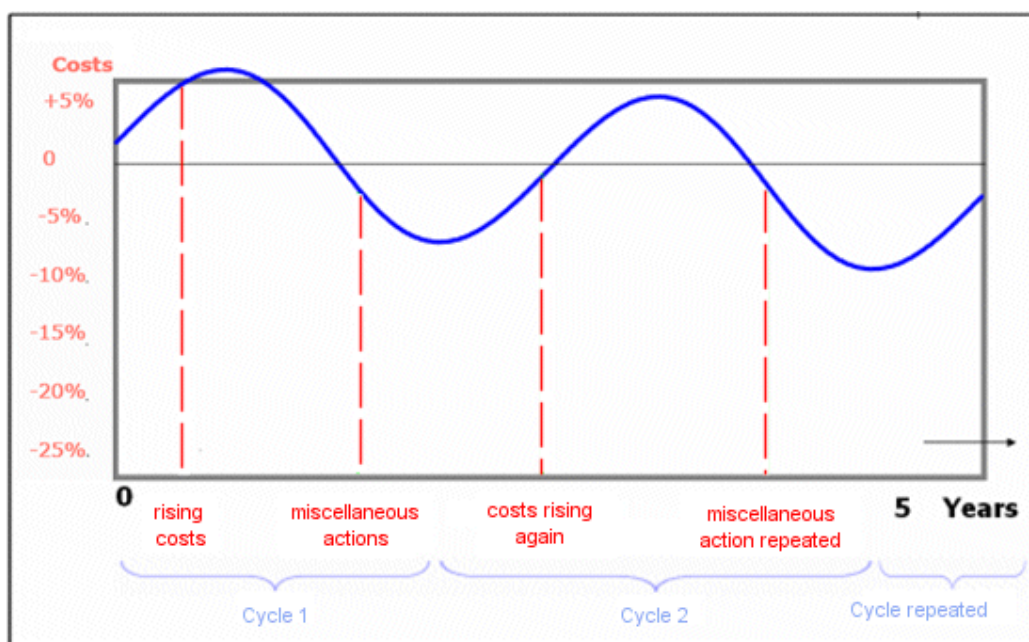


Figure 1: Ad hoc Approach to Energy Savings, from BESS (1)

These problems are overcome with the innovative approach described below.

An Innovative Approach

The energy management approach described here is based on the setting up and operation of a centralised Energy Bureau for the owner of a stock of buildings.

Effectively, the Energy Bureau service provides specialist on-site and off-site energy management to buildings where the local staff do not have either the time or the technical skills within their internal resources.

The innovative elements of this approach are based on:

- Systematic Management -- based on formal methods
- Automation -- using web-based software
- Energy expertise -- delivered mostly remotely in a long-term part-time relationship
- Technical and management support -- delivered remotely

Systematic Management

Systematic energy management saves energy consumed in commercial and institutional buildings in a short period of time without capital investment and without capital investment in energy equipment. This can be achieved by many relatively small actions. Organisational issues and behaviour of people are just as important as technical changes. This is illustrated in the diagram below.

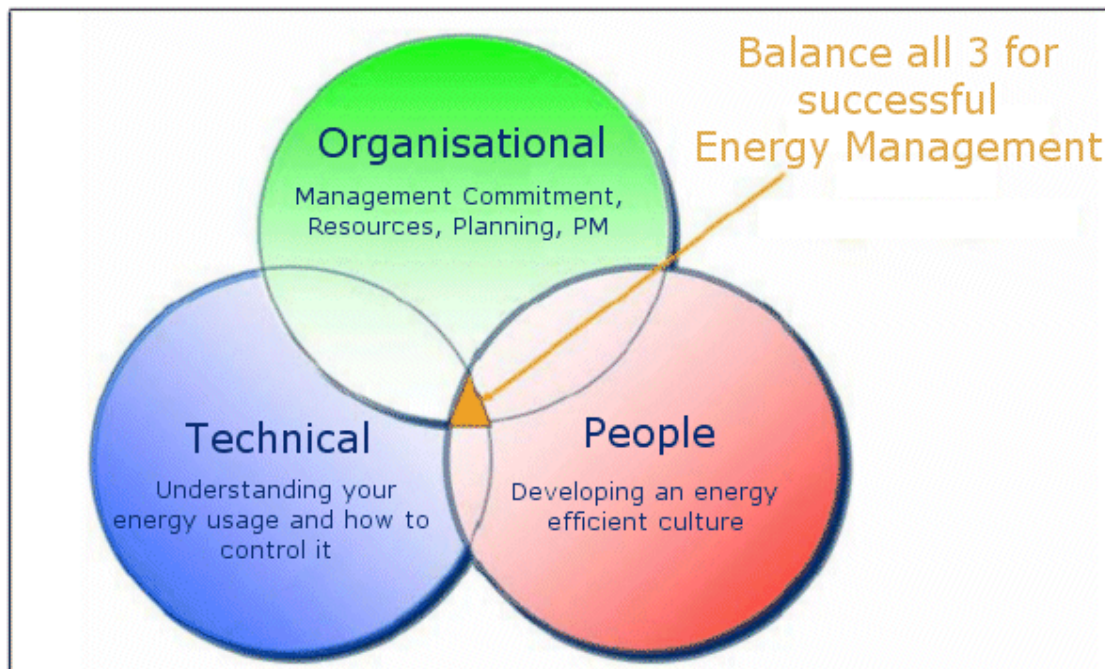


Figure 2: The Key Elements of a Good Energy Management System, from BESS (1)

Systematic energy management approaches are based on the energy management standards IS393 [2] and prEN 16001 [3] and the SEI approach described in EnergyMap [4]. When the techniques of systematic energy management are applied, energy costs continuously reduce, as shown in Figure 3. After the initial phases, management attention and staff enthusiasm is maintained and energy is reduced through ongoing changes in work practices and fast payback capital investments.

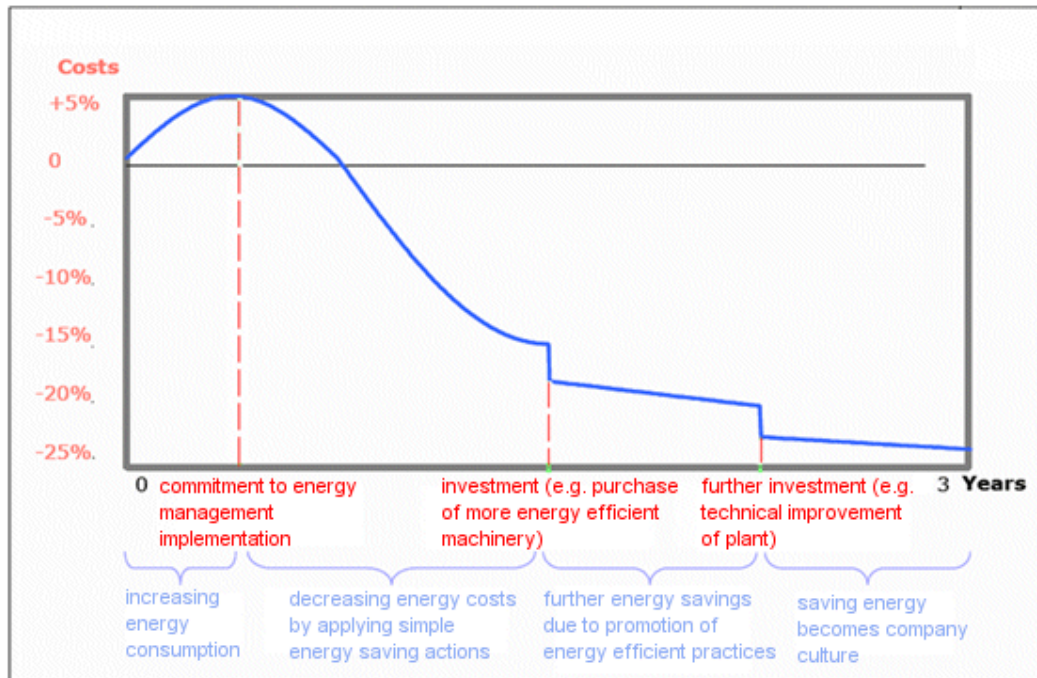


Figure 3: Systematic Approach to Energy Management, from BESS (1)

In the operation of this Energy Bureau, the following aspects of systematic energy management are based on IS 393 and prEN 16001:

- Clear assignment of roles and responsibilities including appointment of energy sponsor, energy champion, steering committee and key players at each site
- Planning, including the setting of objectives and targets
- Operational control of all energy management plans and actions
- Staff awareness and training
- Communication to all staff
- Management of all energy related documents
- Monitoring and measurement against all targets
- Internal and external audits
- Management review by the energy sponsor and the steering committee
- Corrective action when targets are not met

In this bureau, these aspects are automated as far as possible.

Automation

Many of the above processes are automated using newly developed web-based Energy Bureau software linked to the staff intranet. The modules are:

- Energy Bureau Portal (central point of system access, awareness support)
- Actions Management database (managing/tracking actions from e.g. meetings, suggestions, audits etc)
- Meeting Management database (organising and following up meetings of steering committee, key users, etc)
- Energy Related Documents database (bills, building data and drawings, audit results)
- Suggestions database (for staff energy suggestions)
- Energy Bureau Reports database (energy performance and action status reports)

The system helps drive energy saving actions on a day to day basis by helping the Energy Bureau and the Steering Group to continuously track the status of all plans, actions and opportunities requiring the interaction of many people by focusing on:

1. Workflow between people at different departments and sites;
2. Integration of the plans and actions with email - automatically;
3. Emails linked to all the information that people need for their actions;
4. Relentlessly driving forward energy saving actions through automated reminders by email and the flagging of overdue reminders etc.
5. Minimising bureaucratic tasks.

The overall result is that actions get done quickly. They are completed with less meetings, administration and phone-calls.

Energy Expertise

Energy expertise is delivered in the form of a long-term relationship (initially with an on-site visit, then mostly on the intranet), rather than once-off visits. Highly experienced energy management engineers visit each site at the beginning of the project to:

- Do initial energy audits
- Train staff about energy saving at home and at work
- Agree an energy-saving action plan with key staff
- Train key staff on the Energy Bureau software

After this initial visit, all communication normally takes place through the Energy Bureau software and telephone calls. For buildings which are remote and not very large, this keeps energy consulting costs to a modest level, and maximises the effectiveness of time spent by the energy consultants.

Management and Technical Support – Remotely Delivered

Energy consultants located at the Energy Bureau headquarters will routinely review the automatically created reports on energy consumption and the energy actions - weekly or monthly depending on the reporting cycle. When performance is below expectation, the energy consultants trigger special actions to solve these problems. These energy specialists may be viewed as part-time members of the building owner's management team.

Furthermore, the Energy Bureau has a central helpdesk to answer all questions about the Energy Bureau. Addition of users, security access and other administrative tasks are also handled centrally by the helpdesk.

The innovations in this approach are designed to overcome key challenges of the project:

- To quickly complete actions and minimise the time delay between identification of an energy-saving opportunity and the implementation of that change.
- To continuously coordinate the actions of many people at many widely dispersed sites without excessive time spent by building owner staff and/or high consultancy costs.

Case Study: Údarás na Gaeltachta

Údarás na Gaeltachta combines an economic development role with community, cultural and language-development activities. Údarás sponsors hundreds of companies that employ approximately 9000 people.

It is estimated that the Údarás building stock of approximately 300 buildings, comprising 300,000 m² of floor area, has CO₂ emissions of 44,089 tonnes/yr and energy costs of €12.5 million/yr. These buildings are mostly on the Atlantic seaboard and are occupied by Údarás staff, community organisations or companies.

In 2008, Údarás na Gaeltachta established an Energy Management Bureau operated by Enerit Ltd with 50% funding from Sustainable Energy Ireland. This three-year pilot project involves 5 Údarás-occupied buildings and 10 buildings occupied by community organisations or SMEs. The project targets are to reduce energy consumption and carbon emissions for these 15 buildings by 4% consecutively each year, i.e. 12% by Year 3.

The unique challenges in running an energy management bureau for Údarás are:

- The buildings are widely dispersed -- from Donegal to Kerry to Waterford.
- The buildings and units are small, and it is not economically justifiable to have strong local energy expertise employed at each location.
- Because of the remoteness of the locations, it is expensive to have energy consultants make on-site visits.
- Converting obsolete factory buildings to comfortable and energy efficient office buildings.

The team set out to overcome these challenges by demonstrating how a systematic energy management approach combined with advanced web based IT systems can be used to overcome these problems.

This paper reports on the actions and the energy saving results over the first 6 months of the project for the first four buildings added to the Energy Bureau. These buildings are the headquarters building (Ard Oifig), Galway, the regional offices in Donegal (Oifig Réigiúnach Gaoth Dobhair) and Kerry (Oifig Réigiúnach an Daingean) and the Islands' Services Centre (Ionad na Seirbhisí na nÓileán), Galway.

These buildings are office buildings with training and meeting room facilities. They were built between 1970 and 2008. The number of staff ranges from 15 to 101 and the floor areas range from 382 m² to 2,364 m². All the buildings have a combination of open plan areas and offices. Three of the buildings use oil fired central heating with radiators and one uses a geothermal heating system, consisting of a ground source collector and heat pump. The energy performance is typical of similar office buildings in Ireland. Based on 2007 costs, the energy bills for each building is in the range of €15,000 to €100,000 with electricity costs comprising 63% of total costs.

Work Carried out - Central Energy Bureau Activities

The central activities of the Údarás Energy Bureau are:

- Overall coordination information, people and actions.
- The creation of action plans in cooperation with Steering Group.
- Monitoring and targeting system operation.
- Monthly and annual reports.
- Tracking actions on a daily basis.
- Triggering corrective actions, where there is a repeated failure to maintain action deadlines.
- Continually updating all plans and actions on Web with visibility to all relevant staff.
- Organising monthly progress meetings with the steering team (including minutes).
- Tendering for the supply of electricity and fossil fuel each year.

The first task carried out was to identify clear roles and responsibilities for the key players involved in the project. A steering committee was appointed and an energy champion was brought on board. The steering committee is made up of representatives of each of the Údarás regions, the energy champion and external energy expertise and is constituted as follows:

Frank Conlan, Energy Bureau Sponsor
Gerard D'Arcy, Chairman
Fiona Ní Mhurchadha, Údarás Energy Champion
Donal McGettigan, Donegal Energy Champion
Conall Mac Gearailt, South Region Energy Champion
Máirín Ní Fhéinne, Galway Energy Champion
Mike Brogan, Enerit Ltd, Energy Bureau Project Manager/Steering Committee Secretary
Paul Monaghan, Enerit Ltd

The key roles and responsibilities are as follows:

- The Údarás Energy Champion has overall responsibility for day-to-day decisions on the running and expanding of the Energy Bureau.
- Enerit provide several levels of support to the Údarás Energy Bureau:
 - Management support on decisions regarding the structure and set-up of the Energy Bureau
 - Operational support for the day-to-day operation of the Energy Bureau relating to the software infrastructure,
 - Energy advice for the different buildings
 - Daily monitoring of actions and reports
- The steering committee has the responsibility to identify a main sponsor (i.e. a lead manager) in each participant building and this person must demonstrate commitment to the energy-saving programme.

Work Carried out - Activities for Each Building

Once a new building is accepted into the Energy Bureau by the Steering Committee, then a systemised set of actions are triggered (Figure 4). These steps for participating client company/organisations in the Údarás Energy Bureau are as follows:

1. The Steering Committee identifies the Lead Manager (Main Sponsor), local Energy Champion and Key Energy Staff at the new building
2. The Local Energy Champion and Key Energy Staff complete a pre-audit questionnaire, provided by Enerit, for gathering building information prior to on-site audit.
3. The Local Energy Champion gathers energy bills for the past 3 years so that any trends in energy consumption can be identified.
4. The Energy Bureau Portal is configured with the new building details and usernames and passwords are set-up for the energy champion and the key staff.
5. When the pre-audit questionnaire has been completed and the energy bills have been gathered, the first on-site visit is scheduled.
6. During the first on-site visit, an energy audit is conducted, energy awareness training is provided to all staff. The training is customised based on the energy requirements and operation of the building.
7. A kick-off meeting is arranged with the Energy Champion and the Key staff. The kick-off meeting discusses and agrees initial actions based on feedback from the energy audit and suggestions/feedback from energy awareness training. This initial visit is usually completed in 1.5 days.
8. After the initial on-site visit, the energy analysis and the Energy Audit report with a suggested action plan is completed off-site.
9. A follow-up on-site meeting is scheduled with the local Energy Champion and Key staff. Any further actions based on the detailed audit report, the local person responsible for completing the agreed actions and the target dates for these actions are all agreed.
10. During the follow-up visit the local Energy Champion and the Key Staff are trained on how to access the online Energy Bureau Portal, enter information, and view reports and results. During the training, energy bills, electricity meter readings and oil and gas meter readings are entered into various templates via the Energy Bureau Portal.

All of the above steps can be completed for each building in 4 weeks. This was completed for the first 4 buildings in the pilot programme in the period May/June 2008.

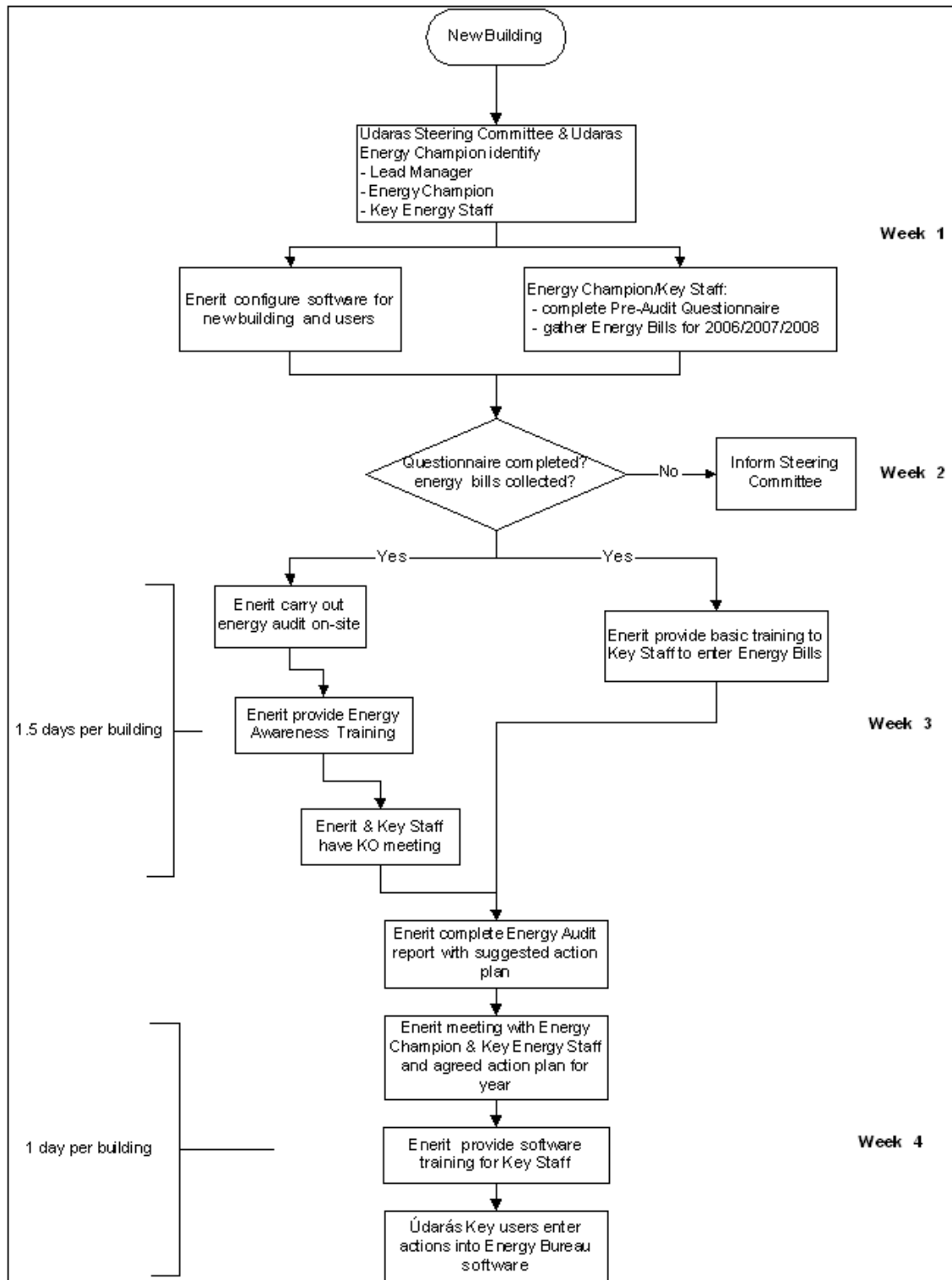


Figure 4: Schematic of information flow and decision points in setting up new building.

Energy-Saving Actions Carried Out

As noted earlier (Figure 3), an effective energy management programme needs to balance activities dealing with:

- Organisational Management
- Technical Matters
- Human Behaviour Change

These three topics are now dealt with separately.

Organisational Management

In addition to the clear identification of people's roles, the actions are planned and tracked in a very unique way. The action tracking management system in the software drives these actions to conclusion through the use of: workflow based on e-mail alerts; automated reminders and alarms; management reports displayed on the intranet. All actions are created, assigned and completed using the Energy Bureau Portal throughout the organisation. These actions are triggered by:

- audit reports
- steering committee meetings
- automated employee suggestion scheme
- training sessions
- other informal events

In the six months since implementation, 159 actions have been assigned through the Energy Bureau Portal and 120 of these actions have been completed. Figure 5 shows a report from the Energy Bureau Portal displaying the breakdown of completed actions by category. Intranet users can click on the chart to drill into more detailed information on individual actions, as required.

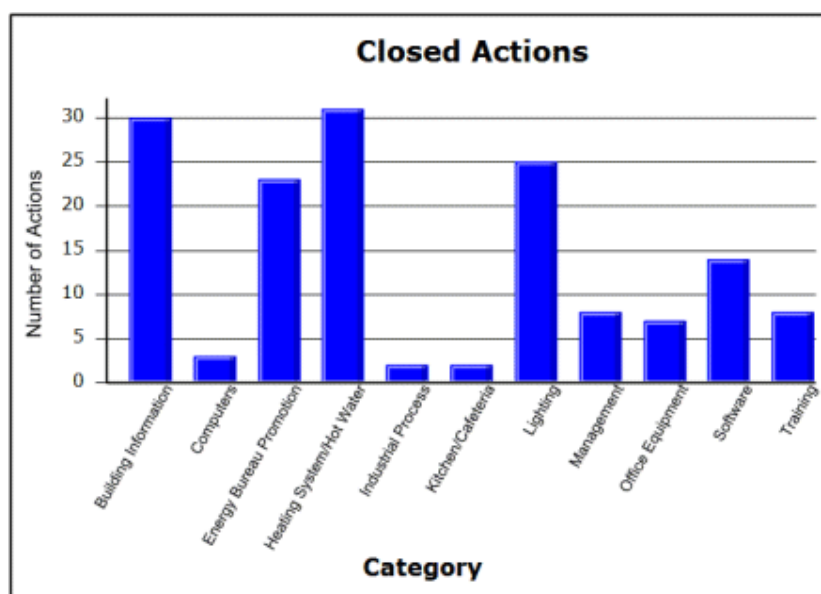


Figure 5: Chart from Energy Bureau Portal -- Completed Actions by Category.

As well as reminder e-mails and alarms, actions are driven to completion by management reports such as that shown in Figures 6 and 7. These reports are reviewed at every steering committee meeting, every key users meeting in each building and remotely, on a daily basis, by the Energy Bureau administration team. When targets are missed, corrective action is taken.

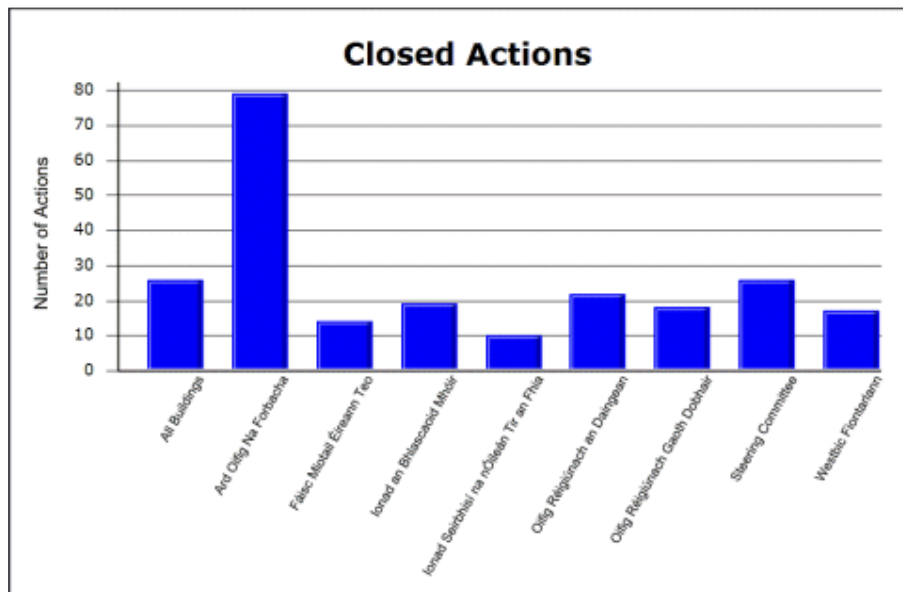


Figure 6: Chart from Energy Bureau Portal -- Completed Actions by Building.

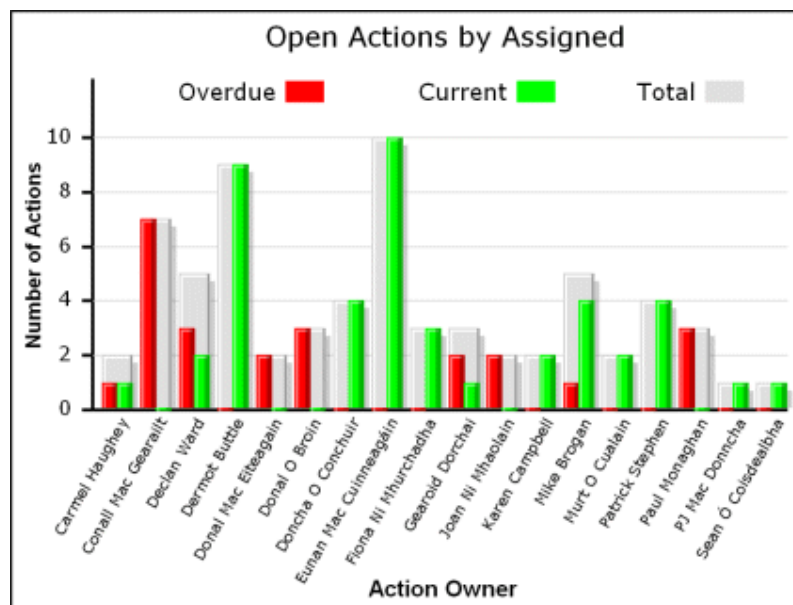


Figure 7: Chart from Energy Bureau Portal -- all Open Actions by Person

The kind of energy-saving actions taken so far are the typical "no-cost" or "low-cost" actions that are recommended at the early stage of an energy management programme. The types of electrical energy saving actions that have been carried out are listed in the two sections "Technical Matters" and "Human Behaviour Change" below.

Technical Matters

- Removing or disabling light fittings in areas where there is excessive lighting
- Replacing incandescent bulbs with CFLs
- Replacing halogen spotlights with mini CFL spotlights
- Installing 7 day time clocks on office equipment (photocopiers, printers)
- Installing 7 day time clocks on water boilers
- Installing motion sensors or daylight sensors in toilets and other areas where suitable.
- Modifying settings on the hot water heating immersion coil controls
- Ground source heat pumps for under-floor heating system: adjusting time clock settings
- Switching off of immersion electric heating to allow the oil heating to take over domestic water heating
- Reducing heating in unoccupied offices

Human Behaviour Change

- Awareness training for all staff
- Access to the Energy Bureau energy-saving reports on the intranet for staff motivation
- League tables on the intranet showing the energy performance of the different buildings
- Competition for prizes at annual staff dinner
- Automated suggestion scheme on the intranet
- Eliminating electric space heaters -- which were informally introduced to the building
- Switching lights off in areas at times when sunlight is sufficient
- Switching off banks of lights in zones of open space areas as each zone empties
- Switching lights off when employees depart, i.e. not leaving them on for the cleaners.
- Audit checks of numbers of computers and monitors left on at night and weekends
- Follow-up instruction to staff groupings that are "switching off" less
- Labelling light switch panels to encourage staff to only switch on lights that are required
- Displaying energy saving posters and other motivational information.
- Sending email reminders to all staff to switch off computers, monitors and other equipment

Overall Energy-Saving Results

In the months of May and June 2008, all the following were completed for all four buildings:

- audits
- awareness training
- software training
- set-up of the actions in the intranet software system

The energy consumption before and after this implementation period are shown in Table 1.

The results indicate that, in the four months before implementation, of the programme electricity consumption in 2008 had risen by 1.7% compared to 2007. This is a common trend due to increased automation of office work.

	Before	After
	Jan to Apr	July to Dec
2007	162096	262414
2008	164819	223155
2008 Compared to 2007	1.7%	-15.0%

Table 1: Total Energy Consumption for the Four Buildings for the Four Months before the Beginning of the Programme, and the Six Months after Implementation Period

In the six months after the implementation period, electricity consumption in 2008 had dropped by 15% compared to 2007. The impact of the programme, so far, is that energy electrical energy is reduced by 15% year-on-year, or by almost 17% compared to a "business as usual" scenario.

Results for Individual Buildings

Results for each building are shown in Table 2. The results show that, in every month for every building, 2008 consumption is lower than 2007. This is an indication of the strong control, introduced by the Energy Bureau's action management system.

Building	July	August	September	October	November	December	Average
Furbo	-3.9%	-17.0%	-11.9%	-8.0%	-15.5%	-6.7%	-10.6%
Gaoth Dobhair	-9.9%	-25.9%	-12.1%	-9.2%	-2.8%	-26.0%	-14.5%
An Daingean	-25.0%	-34.7%	-27.0%	-31.9%	-11.9%	-6.7%	-21.3%
Tir an Fhia	-17.0%	-22.1%	-27.7%	-31.9%	-22.6%	-43.6%	-27.5%

Table 2: Percentage Electrical Energy Reduction in 2008 versus 2007 for Each Building

The monthly electricity profiles for 2007 and 2008 are presented for each building in Figures 8 to 11.

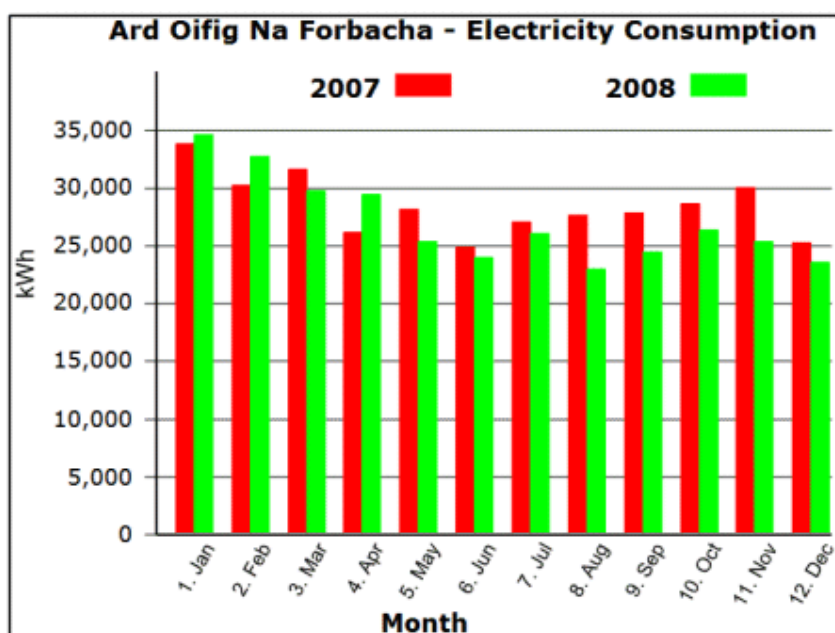


Figure 8: Electricity Consumption for An Ard Oifig Údarás Na Gaeltachta.

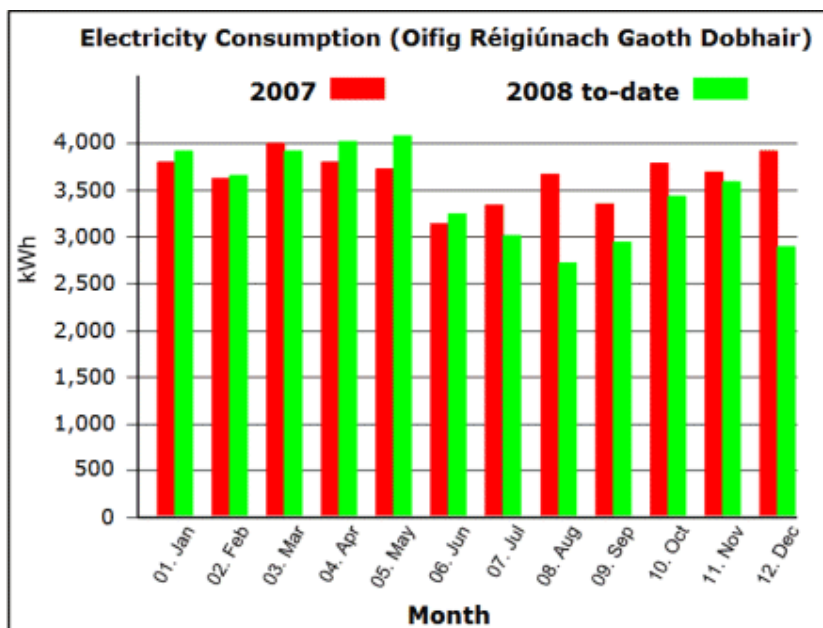


Figure 9: Electricity consumption for Oifig Réigiúnach Gaoth Dobhair.

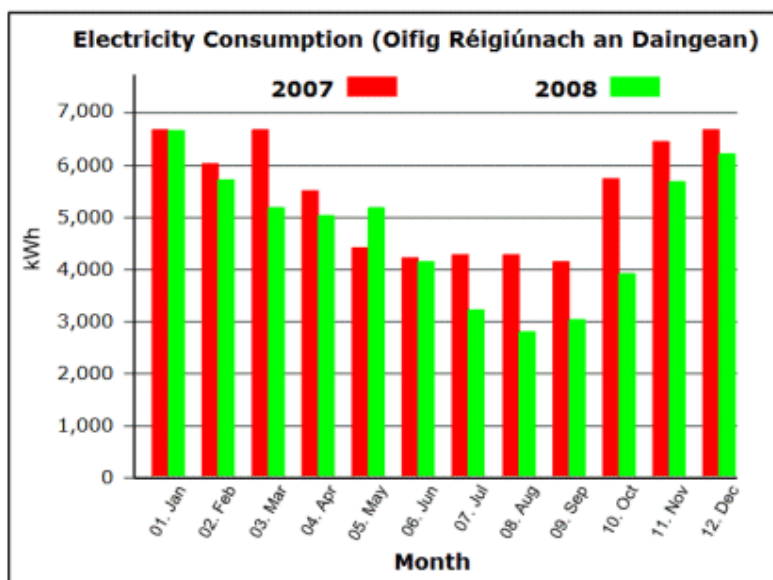


Figure 10: Electricity consumption for Oifig Réigiúnach an Daingean

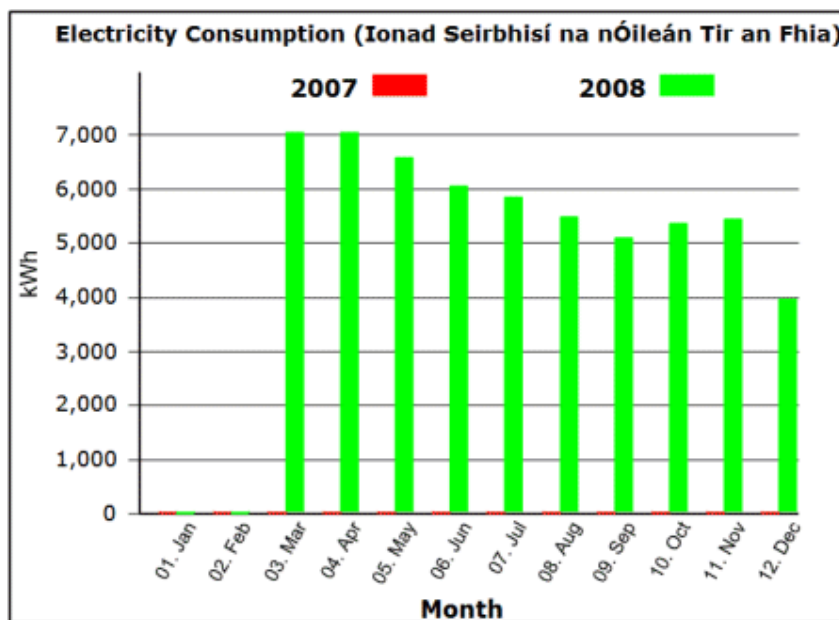


Figure 11: Electricity consumption for Ionad Seirbhísí na nÓileán.

Conclusions

The average reduction of 15% of electrical consumption within six months of implementation shows the approach taken in this Energy Bureau to be highly effective. This reduction was beyond expectation -- the original target was to achieve this reduction over a four-year programme of work. The team will now focus on beating the four-year target in these buildings by a long way.

The systematic approach has ensured that all buildings, managers and staff are included in the programme in a similar way. Management commitment and staff motivation is high. The team members can view on the intranet how their building is performing and what actions each person is to carry out.

The approach to automation has ensured very strict management of actions. As a result, in some cases, actions have been completed within weeks of their assignment. In all buildings, in six months, 219 actions have been agreed and 153 of these have been completed. We believe that this has had a strong affect on the rapid decline of energy consumption.

Because meetings and energy documentation are organised on the intranet, meetings are highly effective and backup information is easy to find.

The next steps at the Údarás na Gaeltachta Energy Bureau are to focus on thermal energy reduction through the 2008/2009 winter and to immediately add another 11 buildings to the system.

We believe that the approaches taken here are directly applicable to other owners of large stocks of commercial and institutional buildings such as: other development agencies (IDA and Enterprise Ireland); hospital groups and other health providers; local authorities; offices of electrical and gas utilities; banks; insurance companies; hotels; and supermarkets.

References

1. BESS: Lackner, P and Holanek, N, "Step by step guidance for the implementation of energy management" BESS Handbook from Project EIE/04/246/S07.38678 sponsored by Intelligent Energy Europe (IEE)
2. I.S. 393:2005 Energy Management Systems - Requirements with Guidance for Use
3. prEN 16001:2008 Energy Management Systems - Requirements with Guidance for Use
4. EnergyMap: <http://www.sei.ie/energymap/>