Engineering in the Kingdom

A special report from the Engineers Ireland An Ríocht Region on engineering’s contribution to social and economic development in Kerry.

Mark Rode’s bronze sculpture, The Champions, is situated at the Clashlehane Roundabout on the N21 entrance to Tralee.
An Ríocht acts local, thinks global

A message from the Chairman, Engineers Ireland An Ríocht Region, Nigel Kenny

It is my great privilege as Chairman of An Ríocht, on behalf of our members and Committee, to be presenting this focus on our region. In the 21 years since An Ríocht Region started life as a sub-branch of the Cork-Kerry Region, An Ríocht Committee has played a key role in integrating the services and talents of its members with the needs of the community it serves. During this period, Kerry society has gone from the dark days of the late 1980s, through the boom years of the Celtic Tiger to again coping with recession. In that time, and perhaps because of the transient nature of prosperity, Kerry has had to adapt and constantly evolve to the point where it has become a robust, flexible and vibrant society with a strong sense of its own uniqueness and worth. An Ríocht members’ professional backgrounds encompass all aspects of this society, including public service, private practice and the education sector, along with a range of engineering disciplines including civil/structural, building services, process, pharmaceutical and medical, and energy and the environment. This diversity of experience is further reflected in the CVs of the current Committee members.

Activities

In 2007, a new Committee was formed which, after a review of previous activities in the region, implemented a series of changes in its approach to its annual programme of events which has yielded positive results. Our goals as a Committee were to:

• run activities that had more relevance to our members and their diverse backgrounds;
• improve our attendances at events;
• provide an informal platform for networking among attendees; and,
• encourage debate about the future of engineering in Kerry.

In September 2008, the Committee wrote a letter, which was sent to our 600 members, to outline our change in approach and to solicit ideas for events. The feedback received was very positive, with many suggestions incorporated into our current activities and our change of approach. For instance, we changed venue from a town centre hotel to a new venue in the Tralee IT campus, which has purpose-built lecture/meeting rooms with ample parking. We now produce an annual programme of events at the beginning of our year to inform members of events, with seasonal newsletters reviewing how events went and where follow-up information can be obtained. We include topics that have a strong local interest. For example, our first event featured a talk on the re-development of Thomond Park. Others included talks on the flooding events that occurred in Newcastlewest; slope stability with particular reference to peat failures; effective thinking styles; the history of the N21 Castleisland Bypass from conception to construction; and first steps in Eurocodes, along with an examination of the codes’ implications for designers. Our most recent programme of events had a strong emphasis on power generation and renewable energy technologies. We had speakers from local consultants, Malachy Walsh and Partners, who discussed a number of large scale renewable energy projects throughout the world, as well as projects the practice is currently undertaking. Endesa Ireland outlined its plans for future gas-fuelled power in Tarbert, Co. Kerry. ESBI and IWEA discussed their vision for future tidal, wave and wind energy developments, both nationally and within Kerry. Finally, we completed our series of events with a presentation by the Spirit of Ireland Project, who talked about their ambitious proposals to harness Ireland’s natural resources and end our reliance on imported energy.

Future of engineering in Kerry

Our keynote event in 2009 was a town hall-style open debate about the future of engineering in Kerry. The Director General of Engineers Ireland, John Power Chartered Engineer, chaired the debate and speakers on the night included Kerry county manager, Tom Curran, IIT president Michael Carmody and Gerry Maloney of Enterprise Ireland. The talk revolved around the potential for engineering jobs in Kerry, with reference to public engineering works and the role of engineers in local authorities, as well as education and the transfer of skills and support for the indigenous sector. The event was well-attended, with over 120 Engineers Ireland members and members of the public, and was covered by local radio and print media. Other events included Engineers Week where engineers from the region visited various schools to promote engineering as a way of life; field trips to Limerick Tunnel; and the formation of our inaugural golf society. We had our first three outings last summer to courses in Kenmare, Castlegregory and Killarney. Our attendance at events has increased from an average of 20 attending to an average of 80 per event, with participation from all aspects of our membership. As a Committee, we have taken great encouragement from these developments.

Focus on the Region

This special report in The Engineers Journal gives a flavour of, not alone the diverse spectrum of activities and support systems critical to our survival and the maintenance of our desired standard of living here in the southwest, but also shows the enthusiasm and the progressive thinking required for success, along with a glimpse of the ambition and singular focus required to be the best. While
success stories such as Kerry Group, Liebherr in Killarney, Astellas in Killorglin and Kerry Airport are well-known, we have attempted to provide insights on lesser-known, but equally successful, activities such as Cadbury’s well-established presence in rural east Kerry. Essential support services that don’t often receive headlines include Kerry County Council’s National Roads Design Office; the critical works carried out on Kerry’s coastline and waterways by the engineering division of the Department of Agriculture, Fisheries and Food; and Udaras na Gaeltachta’s work within Kerry in places such as Pairc Gníomhaíochta. The Institute of Technology Tralee has, for many years, worked hand-in-hand with Shannon Development in fostering and developing innovation and entrepreneurship within the county that has impacted, not just locally, but globally. The impressive ITT North Campus sits alongside Kerry Technology Park with the Tom Crean Incubation Centre, symbolically and strategically, placed on the intersection of both. Lateral and progressive thinking is the theme that links the articles on the Tralee regeneration project and Kerry’s future in energy production.

Serving An Ríocht members

As it has been in the past, the main focus and underlying tenet of the An Ríocht Committee has been, first and foremost, to provide a full and informed service to our members and to enable the progress of our region in general and society as a whole. The enthusiasm and innovation with which the Committee achieves this is reflective of the desire of our members for personal and professional development, and the respect and pride endemic within our community. As a Committee, we are strongly committed to achieving our goal to improve the relevance of Engineers Ireland to our members, especially in these challenging times. We are committed to making our events more accessible to all our members and to identifying projects that can contribute and deliver sustainable employment and growth to our local economy.

We encourage our members to put forward topics for lectures and debates that can improve our knowledge as professionals, but also demonstrate to the public the relevance and importance of engineering to Kerry and society. Engineers are responsible for so much of the built environment and the technologies that allow us live our lives they way we do. The people of Kerry have a lot to be proud of, with many proven success stories and, we are confident, with many more to come, such as the Shannon LNG development in Ballylongford and others in the emerging renewable energies sector. Engineers did not create the economic problems society is now experiencing but, as a profession, we, in Engineers Ireland An Ríocht, believe that we can be part of the solution to rebuild and drive our economy towards recovery. This can be achieved through sustainable developments in energy generation; protection of precious natural resources like drinking water sources and distribution networks; flood protection schemes for vulnerable localities; hi-tech communication networks; improved road, rail and air connections; biomedical industries; indigenous manufacturing not dependent on foreign direct investment; hi-tech internationally-traded services; and continued development of our education standards for existing and future engineers.

We believe investment in infrastructure, that has value for society, can yield high-value jobs, which will have both an economic and social benefit. To deliver fully on this objective, we believe we need greater participation of engineers in government. Engineers are natural-born problem-solvers and innovators. The current systems of governance appear to be devoid of ingenuity and lateral thinkers.

Honesty about sustainability

Engineers around the country need to come together with a clear vision of what is sustainable development and to be honest about failed policies in the past. In the same way that we are changing our approach to the protection of all waters under the river basin management schemes, we need to collectively think nationally, rather than parochially, about how we want our built environment to grow, without damaging future potential. The regions have an important role to play in identifying solutions to the many problems we face. Engineering needs champions who can speak with authority about the many engineering-related topics that effect our society, such as global warming, energy supply and advances in technology. To achieve this end, Engineers Ireland is currently identifying suitable engineering candidates who it believes could best represent and promote the engineering profession when events such as flooding and a big freeze cause such distress to society, and when vital engineering infrastructure fails or shudders to a halt. Now is the time for the champions of our profession to step up and communicate to the public what we as engineers can do. We are the masters of our own destiny.

Nigel Kenny is a Chartered Engineer and Chairman of the An Ríocht Region of Engineers Ireland. Nigel has over 15 years’ experience as a consultant engineer in designing and managing a wide variety of civil/structural and environmental projects, and currently is the principal of his own practice, Kenny Engineering Services, based in Tralee, Co. Kerry.
Endesa is the number one private electricity company in Latin America. It is a significant player in the energy sector of the European Mediterranean region with a growing presence in the Spanish natural gas market. The company is, also, it states, advancing rapidly in the area of renewable energy.

The electricity companies controlled by Endesa had a total installed capacity of 39,656MW at the end of 2008, with annual generation of 149,830GWh and total electricity sales of 172,788GWh to 24.4m customers. Endesa Ireland came into being on January 8, 2009, following Endesa’s acquisition of 20 per cent of the generation assets from the ESB. The sale, worth €450m, was signed in Dublin following approval from all the country’s regulatory bodies. The assets purchased comprise 1068MW of capacity, divided up between four sites: Great Island in Wexford, Tarbert in Kerry, Rhode in Offaly and Tawnaghmore in Mayo.

**Acquisition challenges**

This acquisition presents Endesa with the challenge of improving the efficiency of current plants and the construction of new ones with cleaner technologies. Endesa is developing an industrial plan for repowering and improving the efficiency of the plants it has acquired. After the implementation of this plan, CO₂ emissions will be reduced by over 50 per cent. As part of this initiative, Endesa intends to construct new plants on selected sites including a new plant in Tarbert. For the development of this project, Endesa Ireland has brought together a broad-based team of highly-skilled and experienced engineers, environmental consultants and lawyers experienced in the permitting, licensing and engineering of power generation facilities in Ireland and abroad.

The new plant will be built on the site of the existing power plant in Tarbert, Co Kerry. The site already contains an existing generating station operating on heavy fuel oil with a rated output of 590MW. The existing generating station has been in operation since 1969 and has demonstrated a good track record in relation to environmental compliance and protection of the local environment. The intention is to build the new facility on an open area of the site adjacent to the existing facility.

**Tarbert site infrastructure**

The positioning of the plant in Tarbert offers the opportunity to access the 220kv substation on site via an underground cable, thereby eliminating the requirement for additional overhead lines. In addition, it is a brown-field site with existing generating facilities in operation and staff experienced in the power generation business. The adjacent estuary will also provide sea water cooling, which will optimise the efficiency of the process and hence further reduce plant emissions. Some of the existing site infrastructure (i.e. storage tanks, cooling water intake etc.) will be refurbished and re-used for the new plant.

**Project phases**

The plant will be constructed in two phases, as the reinforcement of the electrical transmission grid is required to facilitate Phase Two and this is not envisaged to be complete until the medium term. Phase One intends to go into commercial operation by the end of 2012 and will involve the construction of a 300MW open cycle gas turbine (OCGT), which will be fired on natural gas. Phase Two is intended to go into commercial operation in 2016 and will involve the conversion of the OCGT to a CCGT. This will increase the plant output from 300 to 450MW.

**OCGT process**

Fuel and air are combusted in the gas turbine, the expanding combustion gases then turn the gas turbine, which in turn powers
a generator. This process produces high temperature exhaust gases. This plant will have a fast-start capability and the efficiency will be approximately 39 per cent (i.e. for every 100MW of heat input, 39MW output, as electricity, is achieved.)

**CCGT process**
The CCGT process is similar to the open cycle process except that the heat energy in the exhaust gas is recovered via a heat recovery steam generator (HRSG), which is also known as a boiler. The HRSG generates high-pressure steam, which is passed to a steam turbine, which in turn powers a second generator. The steam, from the steam generator, is recycled through a condenser, which converts the steam back to water for re-use in the HRSG. Because of the recovery of the exhaust heat energy, the CCGT plant will have a much higher efficiency, approximately 58 per cent. The plant will however retain the capability to operate in both open and closed cycle modes depending on market conditions.

**Environmental effects**
As a state-of-the-art power plant, this development will utilise the best available power generation technologies, combustion control technologies and control systems. In addition, the facility will be operated in accordance with stringent regulatory controls and limits. New gas turbine power plants are efficient, clean, reliable and safe.

The proposed new facility will operate on natural gas, resulting in considerable environmental improvements with negligible particulates and sulphur dioxide emissions. Prior to commencement of operations, the plant is required to secure an Integrated Pollution Prevention and Control (IPPC) Licence from the EPA. The licence will impose an extensive range of conditions restricting emissions in accordance with international and national threshold limits. The existing plant is currently regulated by an IPPC Licence. Advanced gas turbine technology greatly reduces the levels of air emissions from comparatively-sized conventional power plants. As a new facility, the plant will be built using modern technology and emissions will be strictly maintained and monitored. The facility will be subject to reporting requirements and inspections, thereby ensuring that the highest standards are maintained.

All water discharges leaving the site will be subject to treatment and monitoring, thereby ensuring that the concentrations of components are within the threshold limits set in the licence. Consultations are being conducted with the appropriate bodies, regarding the discharge of wastewater. All waste will be removed from the site for treatment or disposal by licensed waste contractors to licensed facilities. No waste will be imported into the facility. No waste will be burned, treated or disposed of on site.

The steam turbine condensers will be sea water-cooled. This cooling water will be extracted from, and discharged to, the adjacent estuary. This is the same process that is currently used on the existing site for condenser cooling, but with the CCGT plant the water requirement will be significantly less.

**National and local benefits**
During Phase One, the plant will provide peaking capacity mainly to support wind generation in the region. During Phase Two operation, the plant will be able to provide base load capacity with high efficiency to supply energy during periods of low wind energy and will still retain its capacity to operate as a peaking plant. The new development will introduce much-needed competition into the energy market and will complement the current liberalisation of the electricity market. The development will contribute significantly to the local economy through annual rates and, in addition, the construction phase of the project will employ up to 500 workers with approximately 40 highly skilled permanent positions thereafter. Services including transport, accommodation, catering, landscaping and trade services will be sourced locally where possible, thereby generating additional local revenue. Gas infrastructure will be brought to the site and this will be the responsibility of Gaslink and Bord Gáis Networks.

**Approval process**
This development has been classified as strategic infrastructure, thereby requiring a planning application to be made directly to An Board Pleanála, rather than the local authority. This planning application, together with a comprehensive environmental impact assessment, was submitted in December 2009. This impact assessment involved considerable consultation with relevant bodies from the local authorities to national bodies such as the Department of the Environment, Heritage and Local Government. An IPPC licence application will be required to be made to the EPA. This permitting process is currently in train.
Shannon LNG Terminal

Shannon LNG is the Irish subsidiary of Hess LNG Limited which is a subsidiary of Hess Corporation, writes Martin Regan. The Company proposes to construct a liquefied natural gas (LNG) regasification terminal on a 257 acre deep water site located on the Shannon Estuary between Tarbert and Ballylongford in Co. Kerry.

Natural gas is the cleanest and most environmentally friendly fossil fuel available and is much more energy efficient than coal, oil or turf. It is the fuel of choice for electricity generation in Ireland, with about 60 per cent of our electricity needs being generated using natural gas.

By switching from oil fired to gas fired power plants over the last twenty years, Ireland has reduced its CO₂ emissions in the power generation sector by about 35 per cent per kWh of electricity produced (Energy in Ireland Key Statistics 2009, December 2009 SEAI).

Over the last decade, Ireland has increasingly relied on the UK to supply the bulk of its natural gas requirements - Ireland currently imports, by pipeline, over 90 per cent of its natural gas requirements from or through the UK.

The UK had a surplus of indigenous natural gas production up until 2003. However, indigenous gas production in Ireland and the UK is rapidly depleting and increasing levels of gas imports are required to meet demand. In some months, the UK imports about 50 per cent of its gas requirements.

National Grid, the operator of the UK pipeline system, forecasted recently that the UK will have an import requirement of about 70 per cent by 2018.

Gas reserves are being rapidly depleted in the UK and throughout Europe. Security and diversity of supply has become a major concern for many countries in Europe and especially for countries like Ireland that are at the end of the existing gas pipeline supply chain.

However, there are sufficient proven reserves to meet the world’s gas needs for between 60 and 70 years at present rates of consumption (BP Statistical Review of World Energy 2009). Liquefied natural gas (LNG) is produced primarily in locations where large gas reserves have been discovered and are far above the needs of the local market.

Cooling natural gas to its liquid state reduces its volume by a factor of 600, making it economic to transport over long distances on specially designed ships.

Natural gas is liquefied and exported from many countries includ-
ing Abu Dhabi, Algeria, Australia, Brunei, Egypt, Equatorial Guinea, Indonesia, Libya, Malaysia, Nigeria, Norway, Oman, Qatar, Russia, Trinidad and Yemen. Importing LNG directly enables Ireland to considerably increase its diversity and security of energy supply by providing the country with a new gas entry point and direct access to worldwide supplies.

Terminal
The terminal will receive LNG from ocean-going tankers, store it, then regasify it and deliver natural gas to the national gas grid. The proposed development will consist of a marine jetty, LNG offloading facilities, up to four full-containment LNG storage tanks, an LNG pumpout and vapourisation system and related buildings and facilities. The jetty will be capable of receiving LNG ships with up to 265,000 m³ cargo capacity. The double-hulled LNG ships carry the LNG at near atmospheric pressure in insulated cargo tanks. The average daily gas demand in Ireland, on an all-island basis during the most recent Gas Year, was about 630 m³ standard cubic feet per day (MMSCFD) with peak day demand of about 940 MMSCFD. The terminal has been designed to have an ultimate peak send out capability of 1bn MMSCFD. A phased approach will be taken to the building of send-out capacity from the terminal, consistent with market requirements.

Strategic Gas Storage
Ireland has natural gas storage to meet average demand for about 11 days. This compares with a storage capacity of about 75 days in Germany and about 95 days in France. Ireland’s very low level of gas storage has not been a problem in the past due to the historic levels of natural gas production in the United Kingdom. However, with the rapid decline in North Sea gas reserves and the consequent sourcing of gas supplies from further afield, the risk of gas supply interruption from physical and political events will be greater in the future. If required, the Shannon LNG terminal has planning permission to build storage capacity equivalent to 28 days of all-island demand.

Pipeline
A 26km gas pipeline will connect the terminal to the national gas grid near Foynes in County Limerick. The Shannon pipeline complies with An Bord Pleanála’s requirement to facilitate a gas link to Tarbert and Moneypoint Power Stations and serves the foreseeable infrastructural needs of the region in a sustainable development manner. The pipeline will connect Co. Kerry to the national gas grid for the first time. This will increase the potential of bringing natural gas to towns such as Listowel, Tralee and Killarney.

Approvals
Shannon LNG obtained planning permission for the terminal in March 2008 and planning permission for the Shannon pipeline in February 2009. Construction consent for the Shannon pipeline was received from the Commission for Energy Regulation in December 2009. An exemption from regulated third-party access to the terminal was received from the Commission for Energy Regulation in April 2010.

The Shannon LNG project could provide competitive, secure and diverse gas supply to the Irish market as early as 2015.

Martin Regan, Chartered Engineer, Commercial Manager, Shannon LNG
Tralee has a high level of social infrastructure including two busy hospitals, Tralee General Hospital and Bons Secours Hospital; the HSE Southern Region Social Services headquarters; the Institute of Technology, Tralee; Kerry County Council Headquarters; local central services centres for the ESB and Telecom Eireann; central bases of two local newspapers; regional rail and bus centres; Kerry Technology Park; and innovation centres. When you add to this list of amenities, its location, convenient to Kerry Airport and Fenit Harbour, it is all the more surprising that areas of Tralee have persistently suffered from social deprivation and a lack of industrial investment for a number of years.

Private investment in retail, housing and tourism support sectors within the past 20 years has transformed much of Tralee into a modern, urban hub. However, a significant section of the town and its people were left behind due to social and economic circumstances and a legacy of poor national planning strategies. Tralee Town Council have been at the heart of physical, economic and social change in the town for decades, ensuring that it was always to the fore in improving the quality of life, as well as encouraging inclusivity and social development, for all its residents. The current regeneration project continues that tradition.

Seizing the opportunity
Following an application in 2001 by the Department of Community and Enterprise to Government to extend the Revitalising Areas by Planning, Investment and Development (RAPID) programme to towns in Kerry, public interest bodies and individuals seized the opportunity that was presented.

A local coordinator was appointed and a community profile was undertaken, which highlighted a number of areas within Tralee in need of major regeneration to help solve underlying physical, economic and social problems, the most significant being the Mitchel’s/Boherbee area of the town.

The core of this area, Mitchel’s Crescent and St Martin’s Park, has been traditionally populated with a social mix from both the travelling and settled community. In recent years, growing social differences have hastened the physical decline of the area. Social and health issues, along with housing stock and infrastructure quality, has prompted a multi-agency response, combining the resources, skills and knowledge of local, statutory and community development agencies, as well as the local community themselves, to develop an appropriate response. The Mitchel’s Regeneration Steering Committee consists of Kerry county manager, Tom Curran; Tralee town...
manager, Michael McMahon; Tralee town clerk, Michael Scannell; and elected members of Tralee Town Council. The committee also includes representatives of: the HSE Southern Region; the Dept of Social and Family Affairs; FÁS; the Gardaí; the North and East Kerry Partnership (previously Partnership Trá Li); the Kerry Education Service; Tralee Town Council Infrastructure Development; RAPID; Kerry Diocesean Youth Service; the Kerry Travellers Development Project; the St Vincent de Paul Society; St Brigid's Community Centre; the Tralee Community Horse Project; and, most importantly, community representatives from the regeneration area.

**Extent of development**

The Mitchel’s area encompasses approximately 10 acres (4ha) of direct regeneration development and will directly impact on the existing infrastructure over an area of 149 acres (60ha) within the town boundary. The overall cost of the project is currently estimated at €90m by completion of current proposals in 2015, having started Phase 1 in 2006. Proposed works include demolition of previous housing stock (built circa the 1930s) and existing low-grade infrastructure; infrastructure upgrading, including municipal storm and foul systems; water main, electricity and communications networks; and construction of new housing, consisting of a mix of minimum B1-rated (BER) standard housing and apartments, minimum A2-rated carbon neutral houses and the upgrading of additional existing housing stock (approximately 600 homes) to minimum C1 rating.

A key element of the project is the construction of an integrated services centre to house critical social services, which will be located in the very heart of the former Mitchel’s Crescent. This will provide hi-tech accommodation for essential community services including the HSE/Springboard, Garda liaison, the North and East Kerry LEADER Partnership, Kerry Education Services, Kerry local authorities/local sports partnership and the Kerry Travellers Development Project, as well as start-up enterprise units to encourage economic development.

Also included is the provision of green areas and stables within the town environs to facilitate housing and care of community horses. Integral to the development is the provision of a five megawatt central district heating system that will provide heat and hot water to some 700 homes in the area, as well as Tralee General Hospital; Kerry County Library; Moyderwell National School; Presentation Convent Secondary School; Lee Strand Dairy; and various community services facilities in the area. Woodchip fuel will be produced locally in association with the Kerry Wood Energy Association.

The strategy adopted by the Mitchel’s Regeneration Steering Committee and Tralee Town Council is one of ‘green regeneration’. All new building stock will be heated by renewable energy sources,
i.e. woodchip and solar panels etc, and will have high levels of insulation, solar control and air tightness, as well as individual metering and heating controls.

Construction will be carbon-audited and low carbon production from materials and processes will be targeted. This process began at demolition stage, with all concrete-based demolition materials being crushed and re-used on site. Rainwater harvesting for use during the construction stage as well as materials traceability and specification, with a view to carbon reduction, will be reviewed. General upgrading of services to provide higher efficiencies are proposed along with the extension of the current LED public lighting scheme, recharging hubs for electric cars and various other recommendations of the National Energy Efficiency Action Plan. Support, technical detail and guidance for this aspect of the project was forthcoming from the Sustainable Energy Authority of Ireland (SEAI), which had developed considerable relevant expertise from the Dundalk 20/20 Project.

Particular investment in time and expertise was given by Declan Meally, director of Dundalk 20/20; Aideen O’Hora, project manager of Dundalk 20/20; and Majella Kelliher, director of the SEAI home energy saving scheme.
Participants
Responsibility for driving the project forward and coordinating all the different elements and phases, including funding, design, planning, and coordination of interested parties falls under the stewardship of Tralee town engineer, Gerry Riordan, and is directed by project director and Tralee Town Council senior executive engineer, Tim McSwiney, supported by Kerry local authorities energy manager Willie Moynihan, and Tralee Town Council administrative officer Niamh O’Sullivan.

Tralee town manager, Michael McMahon, and town clerk, Michael Scannell, have shown huge commitment and support for the project since its inception. Ongoing support and guidance for the development is being provided from the Department of Environment, Heritage and Local Government by Paul Altman of the inspectorate and Deirdre Mahony, assistant principal officer with responsibility for regeneration. The National Building Agency (NBA) are the main design consultants for the overall project and have managed the master planning and coordination of all aspects of the infrastructure development, including the district heating proposals. The NBA’s team is headed by principal architect Madeline Hallanan, building services engineer, Paul Martin and quantity surveyor, Norman Jackson. The creation of the area as a pedestrian-friendly zone was fundamental to the ethos of the project and Malachy Walsh and Partners were commissioned as roads and traffic consultants to assess the existing traffic regime and develop a strategy consistent with Tralee Town Council’s vision for the area.

Predicted benefits
The benefits of the Mitchel’s Area Regeneration project for the town of Tralee, and its contribution to society in Kerry are clear. The investment of a proposed average €13m per annum over the next five years in infrastructure, and in the local construction industry is a welcome boost in these recessionary times. The development emanates from a strong environmental ethos and is sustainable. Social benefits include the provision of a safe, socially inclusive environment for all demographic sectors from young families with children, in the form of childcare facilities and welfare support; to teenagers in the form of youth services and training; to older people in the form of provision of, and support for, living facilities that foster personal dignity. All this, while also providing full support through outreach services. The project also provides quality recreational facilities to all sectors along with work/career support services.

Co-authors
Don Toomey Chartered Engineer, is a structural engineer and project manager with Malachy Walsh and Partners Consulting Engineers, and is currently manager of the firm’s Tralee office. He is currently vice-chairman of An Ríocht and is also a chartered member of the Institution of Structural Engineers. Don has over 25 years’ experience of constructing in the built environment.

Tim McSwiney is a senior executive engineer with Tralee Town Council. His responsibilities include housing; water services; and health and safety. With 30 years’ experience, Tim started off as a resident engineer on bridge works with Limerick County Council Roads Section. In the regeneration project, Tim leads a multi-agency team who work with, and facilitate, the community participation groups in providing technical and administrative support for their projects, helping their communities to organise themselves to positively address their goals.
The Institute of Technology, Tralee, has been at the forefront of learning since its establishment in 1977 and has gained a reputation as a centre of distinction for teaching, learning and research. The institute offers a wide range of full-time and part-time programmes ranging from higher certificate through to honours degree and post-graduate Masters and PhD level qualifications. A world-class programme of research enhances the taught programmes at the institute.

Based on two campuses, the institute has a well-deserved reputation for friendliness and success. It is divided into three schools of study – namely business and social studies, engineering and construction studies, and science and computing. It employs 250 academic staff to cater for the needs of over 3,500 students, consisting of a diverse mix of home, EU and overseas students. The current president of the institution, Michael Carmody Chartered Engineer, FIEI, is a past Chairman of An Ríocht.

A new library and information resource centre (LIRC) on the north campus opened in June 2009. Built by McNamara Construction at a cost of €10.73m, the library building has seating for 439 students over three floors as well as shelving for over 60,000 books. There are over 100 PCs for both research and project use. Throughout the library there are also desk-top plug-in facilities for laptop computers to maximise the flexibility of access to IT facilities.

The institute is a major contributor, both nationally and regionally, to economic, social and cultural development. The taught programmes and research activities are influenced by national and regional needs and are constantly refined to absorb the very latest developments and innovations. There are strong links with external organisations and companies, which enables the institute to deliver true competitive advantage to the local business community.

School of Engineering
The School of Engineering was one of the first schools established in the institute. It is based in the south campus, close to the centre of Tralee. It is divided into two departments, namely agricultural and manufacturing engineering and civil engineering and construction studies. The School of Engineering, in association with FÁS and the Department of Education & Science, also offers block release courses for apprentices in agricultural engineering and carpentry and joinery.

Agricultural and manufacturing engineering courses on offer include higher certificate courses in agricultural engineering and mechanical engineering; ordinary degree courses in agricultural engineering, mechanical and electronic engineering, and production engineer-
ing; and honours degree courses (two year add-on) in agricultural engineering management and manufacturing engineering management. Construction and civil engineering courses on offer include higher certificate and ordinary degree courses in civil engineering, construction and quantity surveying; honours degree courses (two year add-on) in facilities management, construction management and civil engineering management.

The courses in agricultural, civil, mechanical, mechanical and electronic, and production engineering, all have Engineers Ireland accreditation. September 2009 saw the introduction of a new Bachelor of Science in Renewable Energy Management at IT Tralee. This programme aims to produce graduates at ordinary degree level in renewable energy technologies, in the efficient use of energy and in the management of energy. Energy management is taken very seriously at IT Tralee. In November 2009, the estates office of IT Tralee won a national award for ‘Excellence in Co-ordinated Energy Management for Small to Medium Users’ from the Sustainable Energy Authority of Ireland.

The estates office conducts cost-benefit analysis on all energy-related projects and identifies where savings can be implemented. Projects undertaken include, time scheduling of lighting, power and HVAC equipment, rezoning of building heating systems and large-scale upgrading works to the building management system (BMS). The success of the programme is evident through the energy reductions of 20 per cent electrical and 39 per cent thermal for the academic year 2008/2009.

Kerry Technology Park

The Institute of Technology and Shannon Development’s Kerry Technology Park share a 113-acre campus in Tralee. Both organisations have a shared vision for the seamless integration of education and enterprise and a commitment to harnessing the synergies created to greatly enhance regional impact. Turning innovative ideas into successful businesses requires a powerful blend of people, place, culture and imagination. Developing an enterprise culture is about providing the right environment for new ideas to grow alongside existing flourishing enterprises.

The shared vision of the institute and Shannon Development has resulted in the development of one of Ireland’s most successful business environments – Kerry Technology Park (KTP). Since it opened in 2001, the shared campus has become a national role model and the interchange of ideas, skills, knowledge and energy between the institute and technology park-based enterprises involving students, researchers, lecturers and entrepreneurs, underpins the success of the campus as a whole. The park is home to several Irish start-ups that have grown into global success stories, including FreeFlow, Altobridge, PulseLearning, Aspen Connect and Saorgas Energy. The park-based companies have been the recipients of a string of accolades over the years, including DHL Exporter of the Year, Deloitte Fast 50, Deloitte Best Managed Company, three Ernst & Young Entrepreneur of the Year Awards and a Frost & Sullivan Technology Award. Mike Fitzgerald, CEO of Altobridge, is the latest entrepreneur based in the park to hit the headlines, winning the Ernst & Young Emerging Entrepreneur of the Year 2009 title and the GSMA Mobile Innovation Grand Prix - Asia Pacific.

Kerry Technology Park companies are bucking the trend in the current economic climate. There are over 300 people employed at the Park and several companies have recruited staff or expanded
Entrepreneurs, staff and students celebrate the news that County Kerry has been awarded the prestigious title of European Entrepreneurial Region of the Year 2011 by the EU Committee of the Regions.

Altabridge—cutting communications costs

Altobridge is a leading provider of telecommunications solutions that cut the cost of communications to, from and between wireless devices. Headquartered in Kerry Technology Park, Altobridge also has offices in the US, Malaysia and China. Altobridge has three main business units, remote community solutions for MNOs, software/IP licensing for vendor channel partners, and government solutions for private network requirements. Altobridge solutions are based on patented software platforms, Local Connectivity and Split Architecture.

These solutions have proven to significantly cut backhaul and power costs and have been successfully deployed on wireless telecoms networks, aircraft and sea-faring vessels around the world.

The company made a strategic acquisition of the ADC Mobile Network Solutions base station and switching business in December 2009. Altobridge says it can now offer customers the most intelligent, turnkey system for delivering lower transmission costs, lower (and greener) power consumption and optimum returns from the delivery of mobile services to remote communities.

Entrepreneurs recently. In fact, one-in-four companies have hired additional staff in the past 12 months. The future also looks bright for the latest crop of companies emerging from the Tom Crean Business Centre. The incubation centre is home to more than 21 start-up companies such as Youcomply, Text Republic and BioAtlantis.

Innovation and entrepreneurship

Entrepreneurship underpins the ethos of the Institute of Technology, Tralee and Shannon Development, who work together to foster and promote entrepreneurship and enterprise in the local region.

Programmes being run by the institute and Shannon Development’s Kerry Technology Park include:

**Young Entrepreneur Programme**

The Young Entrepreneur Programme was conceived and developed by the Institute of Technology, Tralee, Shannon Development and entrepreneur Jerry Kennelly. Each year, over 600 second- and third-level students participate in the programme, now in its third year. It has received international recognition for its innovative approach to entrepreneurship education and the high level of interaction between students and entrepreneurs. It provides a unique opportunity to explore, and develop, the talents of all participants. It complements traditional learning by layering workshops, case studies and interaction with key business leaders on top of participants’ own ideas.

**Endeavour**

The Endeavour Programme is about giving potential entrepreneurs the opportunity to fast-track their dreams by learning from the best in
a proven environment that is totally focused on bringing businesses all the way from concept to reality. The aim of the programme is to find, grow and launch Ireland’s next generation of entrepreneurs. The programme aims to attract candidates who have a great business concept that has potential to grow internationally. Located in the Kerry Technology Park, Endeavour provides candidates with open door access to globally-focused, successful Irish entrepreneurs. The core elements of Endeavour are mentor coaching, an extensive workshop programme, business stress-testing and an international funding forum, while each successful participant on Endeavour is provided with a hot desking facility and technology support at the Tom Crean Business Centre.

**European Entrepreneurial Region of the Year 2011**

Kerry was recently awarded the prestigious title of European Entrepreneurial Region of the Year 2011 at a ceremony hosted by the EU Committee of the Regions (CoR) in Brussels. The European Entrepreneurial Region (EER) award is designed to identify and reward EU regions with outstanding entrepreneurial vision and to encourage local and regional authorities to do more to promote small business across Europe. Kerry was one of just three regions in all 27 EU States to receive the accolade, along with Brandenburg, Germany and Murcia in Spain. Launched in October, the EER award is open to every region in Europe, regardless of its size, population and wealth. Applications were sought from all over Europe and the successful submission that won the award was made jointly by the Institute of Technology, Tralee and Shannon Development, with the support of Kerry County Council. Kerry was selected based on the quality, efficacy and long-term success of its entrepreneurial vision. It is hoped that with the right support, the award will act as a catalyst for the accelerated development of the enterprise development and support infrastructure in Co. Kerry.

Sean O’Mahony B.E., M.Eng.Sc., is a lecturer in the Department of Civil Engineering and Construction Studies at IT Tralee. After graduating from UCC, he worked for Kerry County Council, Binnie & Partners in the UK, and M.C.O’Sullivan & Co. in Cork. He lectures on site surveying, materials and infrastructural development.
Eirgrid, the Irish Transmission System Operator (TSO), released its 2010 Transmission Forecast Statement in December 2009 to give a snapshot of the rapidly moving energy sector in Ireland [1]. Through the Commission for Energy Regulation’s (CER’s) Gate directives, the TSO has allocated regional areas based on connection offers to implement transmission network upgrades.

At present, the South West region, which represents Kerry and parts of Cork and Limerick, has over 700MW connected including some Gate 2 connections. Across the country, Gate 2 will see over 1,300MW of wind generation processed and Gate 3 will process a further 4,000MW by 2025, where the south west region will receive around 600MW and 800MW in each gate, respectively [1,2]. This will firmly establish wind energy as one of the key business sectors in the south west of Ireland.

Long-term investment
With Ireland’s wind energy future in place through the CER’s Gate directives, wind farm developers need to ensure that their vision is beyond 2020 to mitigate risk and ensure a strong return on investment (ROI). Pre-construction requirements, such as financing, planning, power purchase agreements and grid connection offers, often consume more time and financial resources than originally allocated. As a result, provisions for operation and maintenance (O&M) are often overlooked, even though they can contribute up to 35 per cent of the total lifetime cost of a turbine and up to 49 per cent if a major failure occurs [3]. As the market matures, it is evident that appropriate consideration for lifecycle O&M costs at the outset will yield greater returns in the long-term financial model of a wind farm portfolio.

Energy R&D investment in the region

Employment opportunities in the global energy sector are heading into the west of Ireland, as is evident from the recent announcement of the International Energy Research Centre (IERC), based in Cork. The centre is to receive €20m in direct government funding and €15m from United Technologies, a US-based global industrial heavyweight. This investment will see almost 90 jobs created to work on the development of integrated, sustainable energy systems. United Technologies, which traditionally supplies hi-tech products and services for aerospace and building sectors, has also recently announced an investment deal of $270m (€220m) for a 49.5 per cent stake in Clipper Windpower, a struggling Californian-based turbine manufacturer.

References:
The Irish Times
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Wind energy: optimising operations

Wind energy is one of the key business sectors in the south west of Ireland. In this article, Dr Michael Sheehy, CEO, Gael Force Wind Energy provides an overview of asset management strategies for minimising downtime revenue losses and maximising profits through operational efficiency.

O&M:
Following the construction of a wind farm, there will be a combination of warranties and service contracts in place as the wind farm enters the operational lifecycle:

- availability and power curve warranties from the turbine manufacturer to guarantee the future performance of the wind farm;
- maintenance contracts provided by the turbine manufacturer and/or independent service providers (ISP) for turbine and substation servicing; and,
- an operations management contract to optimise farm performance, ensure farm compliance and manage maintenance contracts and warranties.

The availability warranty provided by turbine manufacturers typically specifies that the farm will be available to generate power for 97 per cent of the year. This essentially allows for 3 per cent of unscheduled turbine downtime due to faults. In an average modern 20MW wind farm, one per cent downtime would exceed €30,000 per annum in revenue losses, so tight monitoring of availability directly influences the bottom line profits. The power curve warranty puts in place a provision to check the performance of the turbine in accordance with international standards to ensure it is operating as specified. However, even with these warranties in place, the compensation for losses is uncommon, as the resources and time required to enforce the warranties generally do not justify proceeding with a claim. Therefore, it is proving necessary to ensure that the operating efficiency of the turbines is proactively monitored and maximised to maintain budgeted revenues.

In Ireland, and across the EU, turbine manufacturers have traditionally provided the maintenance contracts due to the specific technologies and parts used in the turbines. As the sector is maturing, ISPs are also entering the marketplace, which provides competition to reduce the monopoly in the services market. However, in projects backed by financial institutions, the preferred route is to sign long-term service contracts with the manufacturers to reduce risks in the project. The structure of maintenance contracts varies between providers and ranges generally from two to five years in duration,
and it is commonplace to have these extended to 10-12 years. Finally, the operations management contract is what keeps the warranties and maintenance contracts in effect. Recent international studies have revealed that O&M costs are double or triple those originally estimated, so staying informed and up to date with O&M advancements is essential in establishing lean O&M strategies [5,6].

Employment in the region

Enercon, a German wind turbine manufacturer, has recently set up a maintenance base in the resource-rich county of Kerry, where a cluster of wind farm developers, consulting engineers and operations providers are also established. The strategic move for Enercon was based on its strong presence in the south west and Ireland in general, where they have almost 200 turbines installed on the island in over 30 wind farms totalling almost 300 MW of capacity. Christoph Klimek of Enercon Windfarm Services, who is consolidating the maintenance company in Kerry, has stated that they hope to build a technical workforce of more than 20 people in the county to cope with the demands of their maintenance contracts in the region. This base will complement the 34 people that are already employed in regional hubs around the country.

Operational intelligence

Operations management is becoming a key focus of experienced wind farm owners, especially here in Ireland, where the market is saturated in terms of new grid connection offers. Wind farm owners are recognising the benefits of optimising profits from existing projects through lean operations and performance monitoring, or asset management, as it is known in the sector [4].

By the very nature of a wind farm development cycle, the strengths of owners and developers are in the traditional engineering services, such as civil, electrical, project management and planning. For the effective asset management of a wind farm portfolio, experience in turbine technology and data analysis from SCADA systems is also essential to ensure maximum production and thus revenues. With the right analysis tools and software systems in place, effective operations management can perform:

- continuous power curve monitoring to adapt to the characteristics of each turbine and identify any potential deficiencies or arising problems (pitching problems, turbine power constraint and underperformance are just some of the metrics that can be identified) as they happen;
- availability warranty monitoring to ensure that if a turbine is down, the availability clock is counting – operators in the industry know that vague definitions in warranties can lead to incorrect allocation of availability percentages; and,
condition monitoring (CM) systems such as vibration monitoring of bearings, oil sampling for gearbox wear and loading on turbine blades.

A heads up
The bottom line is that even if a turbine is available, it does not mean it is running at optimal efficiency - turbines can sometimes experience up to 30 per cent reduction in efficiency and still be classified as ‘available’. Traditional operations management providers will effectively deal with grid code compliance and liaise with lenders and third party contractors, while some providers also offer monitoring and reporting. However, wind farm owners must take due diligence in ensuring that their operations providers are not only dealing with compliance but also taking the necessary measures for effective asset management.

The amount of service providers and CM systems available on the market today can make it a daunting task to justify investment into a particular O&M strategy. And while it is not economically viable to implement all available optional extras and CM systems, it is a good approach to stay well-informed so as that the right investment is made at the right time. Appropriate consideration for O&M will prove to be the most persistent investment made on any wind farm project, and making informed decisions are crucial for the milestones throughout the lifecycle of a wind farm:
- signing warranties and maintenance contracts prior to operation;
- detecting and eliminating teething problems during the first two years of operation;
- maintaining optimal production efficiencies through real-time performance monitoring;
- providing for end of warranty quality assurance;
- implementing out-of-warranty CM systems to reduce unscheduled downtimes and revenue loss.

Dr Michael Sheehy is the CEO of Gael Force Wind Energy and holds a PhD in Mechanical Engineering. Gael Force provides operations services and software solutions for the management of wind farm portfolios. His company is based in the Kerry Technology Park, Tralee, Co. Kerry.

References:
Since 2007, confectionery company Cadbury’s Rathmore plant has operated with an IPPC License that sets out the permissible levels for emissions to air, noise, water and waste management. Cadbury also applies ISO 14001 to ensure continuous environmental improvement, compliance with regulatory requirements, minimisation of environmental impacts, and pollution prevention. Over the past number of years the company has invested heavily in environmental improvement projects and continues to dedicate management time, manpower and resources to ensuring the processes carried out at the Rathmore plant make a minimal impact on the environment.

**Boiler replacement project**

Existing boilers at the plant were approaching the end of their expected lifespan and capacity to deliver improved efficiency. The most feasible option was to install an entirely new packaged boiler house. The design criteria applied in selecting a system ensured that the proposed plant would reduce carbon emissions in line with the EPA directives and Cadbury’s own environmental objectives. The time frame for replacing the existing system was critical and involved integration of large plant. The existing boilers were shell and tube steel boilers with an existing 34m-high chimney. The boilers selected for installation were...
fully packaged, horizontal, traditional three-pass wetback steam boilers. The maximum continuous rating was approximately 15,900kg/h at 100 degrees Celsius, maximum working pressure 14 bar.g (200psi). The boiler was manufactured to BS2790. To comply with these standards, combustion must be complete by the time the gases exit the furnace chamber. To reduce thermal NOx a larger, more diffused flame, with internal circulation of the gases in the furnace, was preferred. To maximise the benefits of this method required a furnace with a volumetric heat release rate of less than 1.5 MW/m³ and a length-to-diameter ratio of less than three.

The fuel is heavy oil and, therefore, efficiency is of paramount importance. The estimated efficiency of the boiler and burner plant is over 80 per cent. The boiler benefits from generous tube cross-sectional areas to minimise drafts and, therefore, electrical consumption due to reduced resistance. The increased furnace size, which then requires a larger shell, is entirely beneficial to steam quality and boiler responsiveness. As there is a larger volume of water in the shell, the pressure drop resultant from steam take-off is more easily absorbed. The steam surface available for evaporation is increased and, consequently, the steam escape velocity is reduced. The larger steam volume and height from the crown valve to the free surface also reduce priming, aid responsiveness and reduce carry-over. This project aims to achieve business objectives with minimum energy cost. Key environmental benefits associated with these works are as follows:

- reduced energy consumption;
- boiler efficiency improvement from 69 per cent up to 80 per cent plus;
- reduction in fuel costs;
- reduction in NOx; and,
- built-in flexibility for burning biofuel/gas in the future once sustainable supply of fuel is available.

Boiler water feed pumps are also fitted with variable speed drives to help maximise energy savings.

Wastewater and stormwater upgrade works
Cadbury Ireland Ltd is in the process of upgrading its existing wastewater and stormwater management facilities. The works site is an active wastewater treatment plant, which has to be kept live during the course of construction works. The works included the construction of a new stormwater diversion system and treated effluent recycle system. The purpose of the stormwater diversion system is to capture any contaminated surface water and/or firewater that may arise on site and divert it to the on-site wastewater treatment plant for treatment. The new treated effluent recycle system will capture any treated effluent which exceeds license limits and return it to the wastewater treatment plant for further treatment. The stormwater diversion works consisted of the construction of a new stormwater pipeline, a 220m³ stormwater monitoring tank, a stormwater pumping station...
and rising main, and the installation of two Class 1 oil interceptors. The treated effluent diversion works consisted of the construction of a pumping station, rising main and gravity pipelines. Systems are controlled automatically via SCADA links to TOC, pH, temperature and hydrocarbon probes. The works also include the construction of a 2,000m³ stormwater holding tank and ancillary pipelines. The stormwater holding tank is a 5m-deep reinforced concrete structure divided into two separate tanks. The base of the tanks is a 1.2m poured concrete structure measuring 26m x 26m. The walls of the tanks are 550mm thick. The pouring of the concrete required two pumps with a reach of 36m and 52m. For the base of the tank, 800m³ of concrete was required.

**Water treatment project**

Key water requirements at Cadbury Rathmore include process water, cleaning water and a water reserve for fire fighting, which, until recently, were supplied from a single large 570,000L storage tank. An upgrade project was undertaken by Cadburys to separate the fire fighting reserve from the process water and cleaning water. The project required the installation of two 114,000L stainless steel water tanks, 10m high, within a very small available footprint.

This project required considerable engineering planning to evaluate structural loading, detailed tank design and detailed mechanical piping alterations to tie in to existing systems. Incoming water is treated automatically and monitored for water quality.

**Ventilation innovation**

The main hall ventilation system was upgraded to a centralised 12m³/s filtered exhaust system that could be remotely controlled and monitored by the site building management system. The project consisted of removing the various individual fans throughout the process hall and replacing them with a large rooftop air handling unit and large extract ductwork. The extract air handling unit is operated to control main hall temperature with respect to maintaining positive pressure in the hall at all times. Centralising the extract ventilation system gives greater process hall environment control, contributes to reducing site primary energy demand and reduces maintenance requirements. Process air required the ductwork to be treated internally and externally and the air handling unit is plastic-coated, inside and outside. The air handling unit is certified to Eurovent 1886 and the motor is type EEF1.
Kerry NRDO: delivering for the Kingdom
A profile of the Kerry National Roads Design Office

The scope of operations of Kerry NRDO can be summarised as follows: the planning, design and implementation of improvement works to the national road network in Co. Kerry, and the provision of technical assistance to the NRA, on request, for other national road improvement schemes throughout the country.

Kerry NRDO has been engaged in the planning, design, and project management of major road improvement schemes on behalf of Kerry County Council and the NRA for over 15 years with average annual expenditure of €20m. This experience ranges from carrying out large-scale constraints studies (N21 Abbeyfeale Adare), route selection (major schemes on N21 and N22 such as Tralee Bypass and Farranfore-Killarney), through to statutory processes (EIS, Part 8, CPO), procurement of contractors and construction management (Castleisland-Abbeyfeale and Castleisland Bypass).

Pre-contract road design
All pre contract road design work is carried out in house by NRDO staff using AutoCAD Civil 3D, which was introduced in 2005 as the principal road design software in Kerry NRDO. Civil 3D replaced the previous combination of AutoCAD Land Desktop with the DOER (Department of the Environment Roads) software, which is DOS-based. Kerry NRDO has been using Autodesk design software since it was set up and it was this familiarity which led to the decision to evaluate, try and then adopt AutoCAD Civil 3D as the basis for all new designs since 2005. “The principal benefit, and it has proved enormous for us, was the transition to dynamic 3D modelling,” says Donal O’Connell, Assistant Engineer in the Kerry NRDO. “Our design output has increased significantly in many respects. Take the deceptively simple task of altering road alignments to take account of different factors. That used to be a laborious business of tweaking the 2D plans and is now almost instantaneous, allowing engineers to make minute adjustments to the volumes of earth works, dimensions of land-take areas or clearance of structures.”

The design of the road corridors is very important in road planning since, in addition to topographical or engineering factors, it may
be necessary to conform to or avoid land boundaries. “The ability to essentially just click and update all elements of the corridor is a huge time saver and means that more numerous finite designs can be prepared at the route selection stage of a road project.” According to Donal O’Connell, this has also been aided by the ease with which Lidar (laser measurement) data and information from low level aerial surveys can be imported into the Civil 3D design files. Kerry NRDO also has in-house experience available in cost-benefit analysis, safety auditing, drainage design, procurement of specialist consultants, and production of reports and other key deliverables required by the NRA project management guidelines, NRA project appraisal guidelines and the NRA cost management manual. Kerry NRDO operates an ISO 9001:2008 accredited quality management system, and is an Engineers Ireland Continuing Professional Development (CPD) Accredited Employer, recently re-accredited for a further period of three years to 2011. As part of the quality management system, Kerry NRDO operates a policy of continuing improvement to the standards and quality of product delivered to Kerry County Council and the NRA, its primary customers. The NRDO’s main areas of experience/expertise include:

- design;
- statutory processes;
- road safety;
- traffic;
- project management;
- cost management;
- PMG deliverables;
- project appraisal;
- procurement;
- public consultation;
- land and property;
- traffic modelling; and,
- signing and lining schemes.

**N21 Castleisland Bypass**

In 2009, Kerry County Council commenced its latest major scheme, the N21 Castleisland Bypass which was the only construction start nationally in 2009. The design and build contract was awarded to BAM Civil Ltd, Kill, Co. Kildare who commenced on site in May 2009. The scheme entails constructing 5.4km of new mainline (3.3km of which is Type 2 dual carriageway), three roundabouts and 11 structures. The scheme, scheduled to be completed by the end of 2010, bypasses Castleisland west of the town and will connect the N23 Farnanfore Road to the N21 Tralee Road continuing by means of Type 2 dual carriageway to the N21 Limerick Road. Earthworks, drainage and structures are significantly advanced and the road pavement works are underway. Jacobs Engineering Ireland are acting as employer’s representative for the Design Build Contract.

The range of activities carried out by the NRDO includes:

- NRA national signing and lining, design and management of construction contracts;
- cost benefit analysis preparation of COBAs and auditing of external COBAs; and,
- agency work for other local authorities’ safety audits, traffic modelling, post-project reviews.
The Engineering Division of DAFF provides advisory, inspectorial, design and construction service to the Department on fishery-related matters. The services provided range across environmental work in the marine and fresh-water environments, aquaculture-related work and harbour work. The engineering division has a regional office in Tralee, which covers the southern region of the country.

The Tralee office has responsibility for engineering works at two of the six Department-owned and operated Fishery Harbour Centres (FHCs), at An Daingean and Castletownbere.

Since the early seventies, significant Government investment has been allocated to fishery development; and capital development works have been carried out to bring the FHCs to a modern standard to provide a regional network of major fishery harbours for the Irish fleet and the fishing industry generally.

Below are examples of two projects recently carried out by the Department’s engineering division in the region.

**An Daingean Marina pontoons**

An Daingean FHC was established as the sixth FHC in 2008, when the Department took over responsibility for the harbour from Dingle Harbour Commissioners. An Daingean already had a well-established marina facility, which was designed and constructed by the engineering division in the early 1990s, but this was experiencing severe pressure caused by increased usage from leisure craft. This, in turn, was putting strain on vessel space for smaller craft within the harbour generally. In 2008-09, funding was provided for a new berthing pontoon, approximately 100m in length with 14 finger pontoons and an access bridge. The works were project-managed by the engineering division from the Tralee office. The total cost of the project, including consultants design and fees, two works contracts and minor direct labour works, was €750,000.

The design engineering consultant for the project was Malachy Walsh & Partners, Tralee. The Department procured their services by open tender using the new Government Contracts ‘Standard Conditions of Engagement for Construction Consultants’. The new Government Public Works Contract documents were used for the piling and pontoon contracts.

The main contractor for the piling works was BAM Civil Ltd. The works were carried out in December 2008 and entailed the installation of seven tubular steel piles for the new berthing pontoons. The piles were installed by drilling rock sockets. The piles were 500mm in diameter and 25mm thick. A drilling rig erected on a jack-up barge augured and cored through approximately 3m of overburden,
0.5m of weathered rock and 3m into solid rock. Once the hole was cored and cleaned, it was then filled to the top of the rock level with non-shrink concrete.

The 90-tonne crawler crane then placed the pile into the rock socket. A photo showing the equipment used in the works is shown in Figure 1. The main contractor for the pontoon and access bridge works was L&M Keating Ltd. The pontoons were fabricated in the UK by Solent Marine Ltd and delivered to site in January 2009. The pontoon decking is fibreglass grating with an anti-slip surface. The access bridge was fabricated in the UK by Tyne Gangways and is 36m in length. The pontoon works also included the provision of electrical services, water services and safety equipment. Figure 2 shows the access bridge craned into position and Figure 3 shows the completed works. The project was delivered on time and on budget. The use of the new Government contract documents also worked well on the project.

Castletownbere Harbour development

The €38m development on Dinish Island is a major harbour development project including capital dredging, construction of an extension to the existing Dinish Wharf and the replacement of the existing open quay structure. The works are project managed by the engineering division from the Tralee office. The Department engaged Mott MacDonald – Jacobs as consulting engineers on the project. The project commenced in 2004 and work has progressed steadily to date.

The capital dredging works, completed in December 2007, provided:

- deepening, to provide solid rock foundations for the construction of the new 12m pier extension to Dinish Wharf;
- increased draught for vessels navigating through the entrance channel to the harbour – the depth provides for vessels in excess of 6m draught to access the harbour at all stages of the tide; and,
- increased draught at the new 120m pier extension (now completed), and at the replacement structure at Dinish Wharf (90m – presently under construction).

In addition, the dredging contract provided for an 8m draught berthing basin at low water along the entire 210m-length of the new quay berthing face. The dredging contractor, Land and Water Remediation Ltd/DEC, trading as Environmental Dredging Ireland (EDI), was appointed in March 2005, initially to carry out preliminary phase works. The preliminary works involved developing a methodology and securing permits for disposal of dredge sediments (including contaminated materials such as tributyl-tin [TBT], a derivative of anti-fouling paints formerly used on the hulls of vessels). TBT is highly toxic to shellfish and other marine growth and had to be removed with a 25m long reach excavator mounted with a special eco-bucket. The dredge materials were transported to a specially constructed 14,000m³ geomembrane-lined lagoon, where they were stabilised by mixing the silts and clays in batches with cement-bentonite, prior to transport by ship to Germany for recycling.

The works phase of the dredging contract was awarded in December 2005 and completed in December 2007. Figure 4 shows a
The photo of the long-reach excavator in operation and Figure 5 shows a photo of the lagoon area where the silts and clays were mixed with cement-bentonite. The contract was a design-build contract, where the contractor was responsible for development of the methodology and procurement of the statutory permits appropriate to his proposals. The civil works contract for the pier construction was awarded to Carillion Irishenco Ltd in April 2007. The works included development of the new 120m pier extension and replacement of the existing Dinish Wharf, which was structurally inadequate for the size of vessels using the harbour. The new concrete-faced structure along the entire 210m length is a significant improvement on the open timber fender arrangement previously in place on the existing Dinish Wharf. The design was in two separate phases. The first was essentially a mass concrete structure, founded directly on rock, dredged to foundation depth during the dredging contract. The replacement of Dinish Wharf was designed as a piled structure, as the bedrock dipped significantly in this area.

This phase was a complex design, as a sheet-piled, combi-wall construction was required to retain fill behind the pier and to ensure that the Bord Iascaigh Mhara ice plant located here was protected. The combi-wall structure incorporated a rock anchor support. Construction of the new mass concrete quay extension was completed in October 2009. Figures 6, 7 and 8 show the mass concrete quay works. The piled structure is scheduled for completion in September 2010.
The Irish government has encouraged wind energy projects as it strives to meet the targets outlined in the Kyoto agreement. Ireland at present is 93 per cent reliant on imported fuel and has one of the highest emitting rates per capita in Europe. It is for this reason that encouraging the growth of green energy production is so essential to us as a nation.

‘Saudi Arabia of wind’
The west coast of Ireland has been described as, potentially, ‘the Saudi Arabia of wind for the world’. Ireland presently has a total capacity of 1679.30MW generated by 143 wind farms in 25 counties (source: IWEA June 2010). Kerry currently has 14 wind farms in operation with a capacity of 224.34MW. Note also that Coomacheo Wind Farm is registered as being in Co. Cork but three of these turbines are sited in Co. Kerry, and the grid connection is also in Co. Kerry.

This installed capacity is the third highest on the island, with only Donegal and Cork topping this, proving that Kerry is a major player as Ireland endeavours to increase its renewable energy capabilities.

The breakdown of these wind farms is listed in Table 1. There are also numerous other wind farms at various stages of the planning process. The Engineers Ireland An Ríocht committee has helped to increase awareness and drum up interest in renewable energy projects by running several energy-based evening lectures. The average attendances for these lectures exceeded 100, thus showing the level of interest and knowledge there is in the southwest region in renewable energy generation and development.

Sean Doyle of Malachy Walsh and Partners recently gave a fascinating presentation on large scale renewable energy projects that the company have been involved in and are currently working on. Further proof of the interest in the renewable energy sector in the southwest has been the scale of projects worked on by companies based in Kerry. The county has also seen large companies with interests in renewable energy production, both national and international, such as SSE Renewables (formally Airtricity), Wind Prospect and Enercon realise the potential that there is in the southwest and open up new offices in Kerry, joining the indigenous developers such as Saorgus Energy Ltd., Lee Strand and Laune Energy.
Wind farms
Malachy Walsh and Partners (MWP) have been involved in several wind farm projects at both planning, EIS and construction stages. Recently, they submitted planning for the proposed Clydaghroe Wind Farm, Derrynasaggart Mountains, East Kerry consisting of 20 turbines of between 2.3 to 3MW each. Wind farms have positive impacts on local employment. From the onset, professional services are required indirectly, such as consultancy in site investigation, surveying and environmental assessment. Through the supplementary income received by landowners, more disposable earnings become available to the community as a whole. Some of the large developers, such as SSE Renewables, promote community funds linked directly to wind farm production. These funds are used to improve community infrastructure. During the construction phase of a wind farm, stone and concrete is sourced from local quarries, labour, hired machinery and associated maintenance is sourced locally.

Turbine manufacturer representatives will support the local economy in terms of using local shops and sourcing meals and lodging in the locality.

A 20-turbine wind farm could employ approximately 100 people during construction, thus having a positive impact on the local economy for the 18 months or so the construction will take.

In the long term, ongoing maintenance on wind farms provides additional benefits to the community directly through accommodation and indirectly through plant hire and transport. Also, research and development is ongoing in Ireland on methods to manufacture turbine components, such as the tower sections, indigenously, which would be a further long-term boost to the economy.

Transmission Links Ireland
TLI was founded in 1999 in Abbeydorney, Tralee, Co. Kerry. TLI has operated extensively with the ESB, in addition to an affiliation with a large portfolio of clients, in the upgrading, refurbishment and renewal of the all-island electricity network across Ireland.

TLI’s strategy is predominantly focused on the Irish renewable energy market, maximising the efficiency of renewable energy

Table 1  County Kerry Wind Farms (IWEA June 2010)

<table>
<thead>
<tr>
<th>Wind Farm</th>
<th>Capacity (MW)</th>
<th>Commission Date</th>
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<tr>
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<td>3.96</td>
<td>2000</td>
</tr>
<tr>
<td>Tursillagh 1</td>
<td>15.18</td>
<td>2000</td>
</tr>
<tr>
<td>Beal Hill 1</td>
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<td>2000</td>
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<tr>
<td>Beal Hill 2</td>
<td>2.55</td>
<td>2003</td>
</tr>
<tr>
<td>Tursillagh 2</td>
<td>6.80</td>
<td>2004</td>
</tr>
<tr>
<td>Mount Eagle Windfarm Ltd.</td>
<td>5.10</td>
<td>2005</td>
</tr>
<tr>
<td>Coomagearlagh/Kilgarvan</td>
<td>45.00</td>
<td>2006</td>
</tr>
<tr>
<td>Glanlee/Midas Ltd.</td>
<td>31.60</td>
<td>2007</td>
</tr>
<tr>
<td>Clahane (Pallas Wind Farm Ltd.)</td>
<td>40.00</td>
<td>2008</td>
</tr>
<tr>
<td>Mount Eagle 2</td>
<td>1.70</td>
<td>2008</td>
</tr>
<tr>
<td>Coomagearlahy 2</td>
<td>8.50</td>
<td>2009</td>
</tr>
<tr>
<td>Muingnamannane</td>
<td>14.80</td>
<td>2008</td>
</tr>
<tr>
<td>Coomagearlahy 3</td>
<td>32.50</td>
<td>2009</td>
</tr>
<tr>
<td>Ballincollig Hill</td>
<td>15</td>
<td>2010</td>
</tr>
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Malachy Walsh and Partners
Malachy Walsh and Partners were founded in 1967 and have offices in Tralee, Cork, Limerick and London. They have been involved in several innovative large scale renewable energy projects including several wind farms, the second Irish Sea Interconnector, pumped hydro energy storage and tidal energy. The engineering, environmental and planning section of MWP offers a wide range of services to its clients, both public and private. In the past and on an ongoing basis, MWP have carried out commissions for SSE Renewables, SWS Energy, Enerco, Saorgus and other private developers in the Kerry area. MWP have long established experience in wind farm planning and development including areas such as:

- environmental baseline assessments;
- geology, soils, peat stability;
- hydrology, hydrogeology;
- terrestrial and aquatic ecology;
- ornithology;
- noise; and,
- shadow cast analysis.

Figure 2. Turlough Hill pumped storage hydroelectricity plant.
sources and growing an integrated electricity and energy group in competitive markets through contestability across Ireland. TLI is playing a leading role in promoting the development of the Irish electricity grid and in providing a safe, reliable and sustainable electricity network for future generations.

Conclusion

The energy projects outlined above, and further detailed elsewhere in this report from An Ríocht, show the strides that are being made to ensure a greener future for Ireland. They also highlight the capabilities of companies in the southwest to deal with large national and international renewable energy projects. With adequate funding, some of the larger scale projects can begin construction sooner rather than later. This would ensure that some much-needed employment and local economic stimulation could be generated during these recessionary times, as well as giving Ireland the opportunity to take a leading role in the creation of a sustainable future.

Trevor Barrett, MIEI, graduated from UCD in June 2006. He was awarded the Irish Concrete Society Sean de Courcy Award 2006 for best student concrete project: Durability Testing of Self-Compacting Concrete Containing GGBS, PFA, Reclaimed Filler and Steel Fume as Fillers. He began work as a civil engineer with Malachy Walsh and Partners in July 2006. He has worked on numerous roads and drainage schemes and now, predominantly, works on energy-based projects, particularly wind farms. His experience includes on-site progress reporting, road design, drainage design, health and safety documentation, land agreements, site surveying and investigation, and geotechnical assessment. He is currently PRO of the Engineers Ireland An Ríocht branch.
An 800kW wind turbine is to be installed on the company site in Killorglin to generate electricity, in what the company intends will be a landmark project for Co. Kerry and for AICL (KP) itself. All electricity generated will be used on the site to power electrical equipment and, when operational, will meet over one fifth of the site’s electrical requirements and reduce CO₂ emissions by over 1,000 tonnes per annum. A planning application, including a comprehensive environment impact study for the project, has been submitted to Kerry County Council.

The suitability of the AICL (KP) site for wind generation was determined from available meteorological data and data gathered from the installation of a 60m meteorological mast in October 2008. Anemometers and wind vanes on the mast measure wind speed and direction at 40m and 60m above ground level. All information is recorded on a data logger facility, which uploads data to specialist software for analysis by wind energy experts. Site wind data gathered over 18 months was correlated with data from the Met Éireann Valentia Observatory facilitating the determination of long-term wind speeds. Detailed analysis of the wind speed data for the site was undertaken in mid-2009, and showed that the installation of a wind turbine at the site was feasible. In addition, the data confirmed the suitability of the wind regime at the site to meet the daily variation in electrical demand at the site.

Community consultation
Public consultation activities carried out by Astellas included visiting residents within 500m of the proposed wind turbine and distributing an information booklet, which provided the public with information specific to the proposed turbine and turbine operation in general. An open day for the public was arranged for January 28, 2010, in the Boat House in Killorglin. The many photomontages on view presented visualisations of what the turbine would look like from various viewpoints, including the N70 Killarney-Killorglin Road, near
the Puck Goat monument at the entrance to Killorglin Town. Some of the photomontages displayed a visualisation of the turbine from within the town, including the main street and the Town Square. The open day was attended by approximately 70 people from Killorglin and the wider environs. The overall response was positive.

**Electromagnetic interference**

On the day, one of the most common questions related to the potential impact on television reception. As part of the Environmental Report, Cobham Technical Services (UK) was appointed to undertake a specialist measurement of the existing signal strength and quality in the area. A modelling assessment to predict the potential impact on those systems, after the turbine is installed, was also undertaken. The results of the assessment showed that the signal within Killorglin is strong and the wind turbine will have a negligible impact on TV signal quality in the local area.

Other questions related to noise from the wind turbine. It was explained that Astellas propose to erect an Enercon wind turbine, which is gearless (direct drive) technology and will therefore reduce mechanical noise. Noise modelling undertaken has shown predicted noise levels at the nearest noise sensitive locations. Levels will be below the Department of Environment, Heritage and Local Government threshold values of 43dB(A).

**Economic and environmental benefits**

The project will generate both economic and environmental advantages, according to AICL (KP). From an economic perspective, it is anticipated that the project will make extensive use of locally-sourced services, injecting cash into the local economy. In addition, the project will create significant employment opportunities in the area. The environment, too, will benefit. The project will provide a technology that the company describes as clean, sustainable/renewable and efficient. During operation, the generation of electricity on the site will lead to the offset of the following emissions (based on 0.8MW of wind power installed):

- 1,032 tonnes of CO₂ per annum;
- 39.2 tonnes of SO₂ per annum; and,
- 4.4 tonnes of oxides of Nitrogen (NOₓ) per annum.

In addition, it will eliminate the need to import 5,160 barrels of oil and make landfill provision for 140 tonnes of slag and ash. (These calculations are based on data from the SEAI Energy Policy Statistical Support Unit figures and the SEAI publication, *Wind Energy and the Environment, Friend or Foe?*

**Shadow flicker**

While wind energy, like all energy sources, has advantages and disadvantages, AICL (KP) says it is addressing any negative issues to ensure minimal effects on the surrounding area. For example, wind turbines, like other tall structures, can cast shadows when the sun is low in the sky. In the case of a wind turbine, the effect is called ‘shadow flicker’ and occurs when the blades of a wind turbine cast a shadow over a window in a nearby house and the rotation of the blades causes the shadow to flick on and off. Based on recognised modelling techniques, together with the application of meteorological data from the Met Éireann Valentia Observatory, the potential occurrence of shadow flicker from the proposed AICL (KP) turbine is low and significantly lower than the limit values.

Notwithstanding the findings of the assessment, the turbine specified by Astellas will be equipped with an automatic shut-off device, which will be used should shadow flicker present difficulties for any neighbours.

**Commitment to the environment**

Over the past 10 years, the AICL (KP) has prioritised a commitment to good environmental practice. This has involved the implementation of an environmental management system (EMS), which is independently certified to the international standard ISO14001. While, generally, ISO14001 accredited businesses are compliant with legislation, more specifically, AICL (KP) uses the EMS as a risk management tool to control, manage and improve their impact on the environment in the areas of:

- waste treatment and disposal;
- noise and air emissions;
- natural resources;
- energy consumption; and,
- communication and community issues.

For AICL (KP), the EMS is dynamic, as its application extends not only to all aspects of daily business, but to any new projects.
undertaken. All aspects of the proposed wind energy project will be approached in such a way as to meet the requirements of this environmental management system accreditation. This level of commitment to effective environmental quality management will be evident throughout the project’s planning, design and implementation as the siting, construction and operation of the turbine falls under the ISO14001 framework.

Energy management
In 2008, the energy management elements of the environmental system were independently established as an Energy Management System (EnMS) certified to the European Standard EN 16001. The company applies the same management system approach to safety and has a safety management system certified to OHSAS 18001. AICL (KP) has been significantly involved with the SEAI in the identification and implementation of a range of innovative energy-saving projects. Over the past four years, AICL (KP) has been short-listed at the Annual SEAI Energy Awards for the work undertaken on these projects. The projects undertaken by AICL (KP) have, thus far, concentrated on reducing energy consumption within the plant, demonstrating their commitment to the environment.

The installation of a wind turbine is a significant next stage in reducing the Kerry Plant’s reliance on external power, by allowing self-generation and supply of electricity from the wind.
Bunaithe i 1980, is é Údarás na Gaeltachta an eagrais réigiúnach rialtais ar a bhfuil freagracht forbartha eacnamúil, sóisialta agus chultúrtha na Gaeltachta, agus é mar phríomh aidhm aige an Ghaeilge a chaomhnú mar phríomh theanga an réigiúin.

Déanann an t-eagras a mhisean cultúirtha atá rí-thábhachtach a chur chun cinn trí mhaoiniú a dhéanamh ar thionscnaimh straitéiseacha teanga agus cultúrtha, trí thacaíocht a thabhairt don dteanga trína chleachtais oibre féin agus trí chomhoibriú le daoine aonair, grúpaí pobail agus comhlachtai a bhfuil meas acu ar an dteanga agus a chruthaíonn an lathair mar féidir leis an teanga bláthú.

Déanann bord ar a bhfuil 20 ball, 17 acusan atá tofa ag pobal na Gaeltachta agus an fhoireann de 90 duine, 20 acusan a ritheann an Rannóg Seirbhísí Maoine agus Innealtóireachta, cúramh forbartha an eagrais a chur i bhfeidhm. Tá misean eacnamúil an eagrais criticiúil, é ag cothú gnóthai nua agus sean-bhunaithe, ag forbairt bunachar scileanna don réigiún, ag tógáil foirgnimh speisialtóireachta nó réamhaonaidh do réimse leathan gnóthaí agus ag mealladh infheistíocht ón dtaoibh amuigh.

Tá Rannóg Seirbhísí Maoine agus Innealtóireachta an Údarás ar fáil as an eagrais criticiúil, é ag cothú gnóthai nua agus sean-bhunaithe, ag forbairt bunachar scileanna don réigiún, ag tógáil foirgnimh speisialtóireachta nó réamhaonaidh do réimse leathan gnóthaí agus ag mealladh infheistíocht ón dtaoibh amuigh.

Áiseanna do chúrsaí oideachais tríú leibhéal agus ionaid forbartha gnó do ghnóthaí tosaithe. Déanadh na áiseanna seo ar fad a forbairt ar an tréidlacht, agus a thabhairt do gnóthaí agus a bhíonn fós in ann a chur ar fáil agus a fostar air i gceannas.
(SEAI) cuireadh an tÚdarás ar an ngearrliosta i gcóir gradaim caomhnaíthe fuinnimh an SEAI do 2009 sa chataogóir ‘Sármhaitheas i gcóir gradaim caomhnaíthe fuinnimh beag/measarth’ as an obair a dhein sé i laghdú an méid fuinnimh a úsáideadh i 12 áitreacha gnó ná réigiún Ghaeltachta. Agus laghdú de 17% ar úsáid fuinnimh sa chéad 10 mí in oifigí an Údaráis féin, déanadh na hionchais a shárú mar nach raibh súil an laghdú seo a bhaint amach go dtí bliain 4 den togra.

Ar na forigintí atá san áireamh tá áiseanna turasóireachta, planda cógaisiochta agus áiseanna traenála agus teagaisc. Go stairiúil déanadh formhór na hoibre dearraidh agus tógála ar phunann maoine an Údaráis go hínmheánaach mar bhailteach ag baint úsáid as foireann innealtóirí agus teicneoirí an Údaráis (foríne ar leith d’innealtóirí seirbhísí foirgníochta agus de thógálaíthe san áireamh), ach tá an bhéim anois ar chur chuige togra-bhunaithe, áit go ndéanann foireann chálaithe de bhainisteoirí togra inmheánaach an Údaráis an obair dearadh agus tógála a bhaisteáidh. Déantar an obair féin a sheachfhoinsiú trí phróiséas soláthar poiblí.

De bharr gur san earnáil ardteicneolaíochta a fheidhmionn méid arírithe de chlaint-chomhlachtaí an Údaráis bíonn innealtóirí ó réimsí difriúla innealtóireachta ar nós na réimsí meicniúil, tionsclaíoch, leictreonach agus faisnéis an eolais san foireann oibre acu. Is i mbailte móra a bhíonn fhuitleachtaí innealtóireachta ar fáil san oireachtas Chomhchoiste na Gaeltachta, ach ní féidir le náisiúin a mhairteach a chur i bhfeidhm sa phoiblí.

An tÚdarás cláir leathan traenála agus oideachais do dhaoine aonaracha agus do chomhlaicteorí atá a irsnaigh a réimeadh is an leithéid d’fhostaíochta a fhágadh i deireadh an chathartha. Tá sé tar éis cur i gceantar Ghaeltachta a mhíshreachadh a bhíodh san obair a ghearradh sa Bhreatain Mhór. Tá sé tar éis an cheann de dhaoine a chruthadh an obair a fhágadh i deireadh an chathartha agus a bhíodh san obair a fhágadh i deireadh an chathartha.

Anuas ar seo, séard atá rí-thábhachtach don Údarás ná forbarth scileanna agus saineolas an phobail i gcoitinne agus daoine a spreagadh i dtreo féin-phobail agus fhoilhráim fas-saoil. Tá sé tar éis cur i gceantar scileanna a fhágadh i deireadh an chathartha.

Bhí sé tar éis ceart i rith an chéad taisteal ar a chur i measc dhuine a bhíodh san obair a fhágadh i deireadh an chathartha. Tá sé tar éis cur i gceantar aonair chun an obair a fhágadh i deireadh an chathartha a dhéanamh. Tá sé tar éis cur i gceantar aonair chun an obair a fhágadh i deireadh an chathartha a dhéanamh.