



CORRIB GAS COMPLETES 83KM OFFSHORE PIPELINE

A significant milestone was achieved in the Corrib gas project this summer with the successful laying of the offshore pipeline, stretching from the gas field 83km out in the Atlantic Ocean to the landfall site at the tip of north Mayo. Ronald Hogenbirk, Project Engineer, Shell E&P Ireland Ltd, reports on the technical challenges that had to be overcome

The Corrib gas project is one of the most exciting infrastructural projects ever undertaken in Ireland – and one of the most challenging, on many levels. While its instant recognisability throughout Ireland, and further afield, is largely due to the controversy that has surrounded it, many of the technical challenges it has faced, and overcome in recent months, are also worth recording. Laying an 83km long pipeline from the rugged coastline of north Mayo to a depth of 355 metres out in the wild Atlantic Ocean was always going to present difficulties. And so it transpired this summer as the 1,000-strong pipelines team, both onshore and offshore, overcame an array of challenges, to successfully lay the offshore section of the pipeline to the most westerly gas field in Europe. The challenges ranged from protester activity to subsea topography and from harsh metocean (a term used to refer to the combination of meteorology and oceanography) conditions to maintaining health, safety and environmental standards. The gas field itself is located 3,000 metres below the seabed in a water depth of 350 metres, and is being developed using a subsea tieback infrastructure – the first of its kind in Ireland. An onshore pipeline, the route of which is the subject of an impending An Bord Pleanála decision, will link the offshore pipeline from the landfall site at Glengad onwards for nine kilometres to the Bellanaboy Bridge gas terminal. Here the gas will be processed and then distributed through the Bord Gáis Éireann network.

The five wells at the Corrib field were completed and made

ready for production late last year and the object of this summer's offshore programme on the Corrib project was to lay the main gas pipeline from the shoreline at Glengad to the central subsea manifold, and connect all the wells to the manifold. Work at the terminal site, meanwhile, also continued apace throughout the summer months and it is now over 80 per cent complete. At the peak of construction activity on the site in recent months, over 1,100 people were employed there and, while this has now dropped to over 800, it remains one of the largest construction sites in the country.

Offshore development programme

In leading the team charged with laying the Corrib offshore pipeline this year, Gerry Campbell, Corrib Pipelines Project Manager, faced a combination of challenges. While the technical ones were the kind every engineer dreams of having to rise to, it was the challenges of the non-technical variety – security considerations, unpredictable weather patterns and Shell's stringent health and safety requirements – that made the achievement of this year's goal all the more special for the man with 20 years' experience in the oil and gas business. "Our top priority is to ensure the safety of all employees," Gerry notes. "With the diverse range of companies working for us and with employees from different cultural backgrounds, huge effort went into communicating our safety standards to all employees and listening to their suggestions on how to improve the safety of our operations." Gerry has worked around the world with Shell prior to

First glimpse of the Corrib gas pipeline, being fed through the stinger into Broadhaven Bay.



coming to Mayo to work on Corrib and has extensive experience of instilling safety as the primary focus of project teams. Nonetheless, this was a challenge of new proportions, but he is warm in his praise for the way his team carried it off. "The manner in which local and foreign contractors took on the challenge and focused on safety standards was very impressive," says Gerry. "Preparation and planning are the key components in successful delivery and our preparedness for every eventuality ensured that we were successful." This emphasis on planning is an integral part of every phase of this project. Prior to this offshore pipe-lay programme, significant time and effort was invested in carrying out preparatory work, which in itself took substantially longer than the pipe pull-in and pipe-lay activities.

Pipe-lay execution

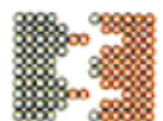
Firstly, the landfall site at Glengad was prepared by installing worker welfare facilities as well as the linear winch required to pull the pipe ashore. In addition to this, water storage facilities were put in place to facilitate hydro-testing of the pipe once it was laid. The nearshore dredging works, to construct a 1,500m shallow water trench in advance of the pipe-lay itself, started in early May, which in north Mayo is the first seasonal opportunity for these types of activities. Broadhaven Bay is particularly exposed to the severe Atlantic winds and swells, which had a significant impact on the project execution, specifically on the dredging and pull-in activities.

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One of the most challenging phases of the overall programme was the pull-in of the 20" steel pipeline at Glengad beach. In fact, this first section consisted of three pipelines, strapped together on the pipe-lay vessel: the 20" steel pipeline; a 12" HDPE (high density polyethylene) conduit; and a 10" HDPE water outfall line. The latter runs approximately 13km offshore along with the main gas pipeline. A continuous period of six days with sea states between one and two metres was required to successfully execute the pipe pull-in.

A favourable weather window arrived at the end of June just in time for Solitaire, the world's largest pipe-lay vessel, to arrive in Broadhaven Bay and commence pipelay by pulling the pipe ashore.

On June 25, the steel pull-in wire 2,400m long and 102mm in diameter was installed in the pre-dredged trench with an accuracy of $\pm 0.2m$ by reeling it from a dynamically positioned vessel. One end of the pull-in wire was placed in the 500-tonne linear winch at Glengad, and the other end handed over to the pipe-lay vessel, standing off at approximately two kilometres from the coast.

On the pipe-lay vessel the pull-in wire was connected to the first pipe section and, subsequently, strings of 24m were welded together and pulled off the vessel towards the beach. When the pipe had reached the shore, Solitaire continued to lay the pipe from Broadhaven Bay out to the Corrib field 83km away.

At the lay-down area, in 350 metres of water, the subsea end of the pipe was required to be placed with high accuracy into a pre-installed termination unit. This operation was controlled by Technip's vessel, Geoholm, and the aid of two ROVs (remote operated vehicles) providing the eyes, ears and hands for this deepwater operation.

On July 22, in less than a month, 7,000 sections of pipe were welded together and the pipeline end was successfully locked into position near the central manifold.

To maximise stability in shallower water and provide protection for the water outfall line, the pipeline was trenched from the landfall to a point some 13km offshore. This trenching was carried out post pipe-lay using a subsea trenching machine RT-1 (Rock Trencher 1) from CTC, deployed from the multi-purpose support vessel Maersk Advancer. The pipeline has now been pressure-tested and trenched, while works on reinstating the beach and landfall location to their original condition are completed.

A team of archaeologists and marine mammal observers witnessed all marine works in this sensitive environment, which includes a Special Area of Conservation (SAC) and a Special Protection Area (SPA).

Contractors

This year's subsea work and pipe-lay operations were characterised by meticulous planning, logistical co-ordination and excellent collaboration between Shell and a host of contractors. In total, almost 1,000 people were involved in the offshore work, between Glengad, Killybegs, Belmullet and Dublin. Irish contractors, Roadbridge, carried out landfall preparation works. They also executed the onshore and inter-tidal zone trenching using backhoes from a temporary rock causeway. The Allseas Group, one of the major offshore pipe-lay and subsea construction companies in the world, supplied the pipe-lay vessel, Solitaire, supporting survey vessels and pipe supply ships. The additional fleet used in the offshore pipelay programme – including spud barges with backhoes, split hopper barges,

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and a trailing suction hopper dredger – was contracted from Dutch specialist dredging contractor Van Oord. Post pipe-lay trenching works were carried out by CTC Marine, who operate some of the world’s largest, most technically advanced fleet of marine trenching vehicles for the international offshore construction industry. Meanwhile, a separate fleet of vessels supplied by Technip was engaged in installing equipment offshore at the Corrib field, including flow lines, which were installed and tested between the five wells and the subsea manifold. Testing was also carried out on the umbilical jumpers used to control the subsea wells. The Corrib gas project has been beset by many difficulties in the 13 years since the field was

discovered. This summer, however, it recorded perhaps its greatest success to date, with the completion of the complex offshore pipe-lay and subsea tie-in activities. A triumph of subsea engineering, it also represented a pioneering move for offshore energy development in the harsh and unforgiving Atlantic waters off the Irish coast. The lessons learned and information gathered from this phase of the project may yet prove invaluable to offshore wind and wave energy projects in the west of Ireland in the future. For the Corrib team, however, the focus is firmly on the next phase of work on this groundbreaking project. Further challenges await, but the same attention to detail will be applied in approaching them. Φ



The Solitaire and supporting pipelay vessels in Broadhaven Bay during the offshore programme, June 2009.

Ronald Hogenbirk holds a Masters Degree in Offshore Engineering from Delft University of Technology. His special interests include ship hydro-mechanics and numerical fluid modelling. He was employed by Shell in a variety of marine engineering and field development roles, based in The Hague, The Netherlands. In May 2007, he started as pipelines engineer and has been involved in the pipepull operations at Glengad this year.

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NISO AWARD WINNERS

A roundup of news from companies working on the Corrib gas project.

RPS reconfigures Corrib pipeline

RPS were appointed by Shell E&P Ireland Ltd on behalf of the Corrib Partners in January 2007 to assist in implementing the recommendations of the Cassells Report from the previous year, according to P.J. Rudden Chartered Engineer, FIEI, group energy director, RPS. This involved the rerouting of the onshore pipeline in the vicinity of Rossport. RPS also had a brief to undertake the town planning, engineering, EIS and, most significantly, the local stakeholder aspects of the onshore pipeline between the offshore section and the gas terminal at Bellanaboy Bridge. The most challenging aspect of the assignment was to create a new engagement

with the local people on the onshore pipeline route. RPS, thus, opened a community liaison office in Belmullet staffed by three people including a local consultation manager. Through a series of open days and community workshops a new set of siting criteria were formulated under the three headings: community, environmental and technical. Using these criteria, eight new alternative routes were chosen and evaluated resulting in three shortlisted routes which were further refined to five, and then back to one recommended route announced in April 2008, which formed the basis for the planning application to An Bord Pleanála in 2009. RPS advised Shell E&P Ireland

Ltd on the strategic planning issues that underpinned the planning application under the Strategic Infrastructure Act. RPS were key technical witnesses at the An Bord Pleanála Oral Hearing into the onshore pipeline development in May/June of this year. Apart from supplying technical environmental and communications consultancy, RPS has also undertaken the wayleave negotiations with local landowners using one of their most experienced agri-scientists. Following the October 2009 decision by An Bord Pleanála to defer determination of the Planning Application, RPS continue to assist Shell E&P Ireland Ltd in the supply of additional information to An Bord Pleanála.

Bord na Móna Environmental install wastewater treatment plant at terminal

Bord na Móna Environmental is currently installing a wastewater treatment plant at the Corrib gas terminal site consisting of two area-specific septic tanks, each accompanied by a 8.5m³ pump station with a set of duty/standby flameproof pumps and a flameproof ultrasonic level probe controlling the pump cycle functions, Peter Quinn, project engineer, Bord Na Móna Environmental Ltd, reports.

Effluent from the pumps stations is pumped to a group of Puraflo modules. The septic tanks and soil percolation area are designed and supplied by Shell. There are a group of 12 modules at the site, with nine treating the effluent from the site administration building and the other three treating the effluent from the control room building. The treated effluent leaving the Puraflo modules is expected to have a biological oxygen demand (B.O.D.) less than 20mg/l and a total suspended solids (T.S.S.) less than 30mg/l. Final treatment and polishing occurs through a 300m² raised soil percolation bed positioned below the Puraflo modules.

Bord na Móna Energy Ltd utilises peat from terminal

As part of Shell's Corrib gas project, it was necessary to remove approximately 450,000m³ of peat from the terminal footprint, writes Brendan Moyles of Bord na Móna Energy Ltd. The peat deposition site, where the removed peat was received, re-loaded for internal site haulage and finally placed, is located on industrial cutaway peatlands in Srahmore, near Bangor-Erris in Co. Mayo. The deposition was governed by extensive planning conditions, as well as separate conditions imposed as part of the waste licence issued by the EPA. The peat was spread over low areas (bays) to depths of on average 1.4m to 1.8m. The deposited peat was then profiled allowing for water run-off. Following deposition activities and the implementation of the agreed monitoring programme, vegetation was allowed to establish naturally, primarily soft rush (*Juncus effusus*) as well as other native peatland species.

Long-term benefits for contractors on Corrib project

The experience of working on the Corrib project onshore gas terminal, will lead to enhanced skills and performance levels for the contractors involved, according to Keith Elliott, project manager for PM Group, the construction management contractor for the terminal. "Working on this landmark project has been both a challenge and a privilege, and has given us the opportunity to prove that we can deliver a world class health, safety and environmental performance," he states. "Most importantly, we believe that the experience of Corrib will bring

long-term health, safety and environmental performance benefits for PM and the other contractors, and for the Irish construction industry as a whole."

PM fulfils the role of project supervisor for the construction Stage (PSCS) and, with the co-operation and support of Shell E&P Ireland Ltd, has established what Keith describes as a world-class health, safety and environmental management system. He notes: "The Corrib Terminal has twice achieved the milestone of 1m hours worked without a lost-time injury and

the National Irish Safety Organisation (NISO) recently recognised PM Group with a distinction award at its 2009 annual awards on the strength of its performance at Corrib." Supported by Foster Wheeler Energy Limited, PM's contract scope includes the procurement of construction contracts, development and management of the construction budget, planning, co-ordination and supervision of all construction work, quality assurance and the administration of construction contracts from award to close-out.