The Corrib Gas Tunnel
The Corrib Project

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The Corrib development has four distinct parts:
1. The offshore wells and subsea facilities
2. The offshore pipeline from the wells to the landfall at Glengad
3. The onshore pipeline between the landfall and the gas terminal
4. The Bellanaboy Bridge Gas terminal

The Corrib Reservoir
Approx 3km below the seabed

Wells & Subsea Facilities
Seabed approx 350m below sea level

Offshore Pipeline
83km

Onshore Pipeline
Approx 8Km

Bellanaboy Bridge
Gas Terminal

Landfall Valve
Installation

Not to scale

The Onshore Pipeline

Permission for the overall Corrib development, including the onshore pipeline, was granted in 2002. In 2006, in order to address community concerns about the pressure of the onshore pipeline and its proximity to local housing, Shell E&P Ireland Limited (SEPL) agreed to select a new onshore route and design.

In February 2009, SEPL submitted a new onshore pipeline application to An Bord Pleanála, the Irish planning board. In November, the board requested further information and sought some modifications to the proposal. One of the key changes suggested was that the pipeline be routed through Sruwaddacon Bay instead of running over land in Rossport.

In order to preserve the integrity of this sensitive habitat, SEPL responded to the board’s request by proposing a route and design that included a 4.9km tunnel being laid under Sruwaddacon Bay. In January 2011, the board approved this proposal.

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The Corrib Tunnel

The onshore pipeline is the final phase of the Corrib gas project to be completed. The onshore pipeline section is 8.3km long and 4.9km of this will be installed in a tunnel, the majority of which will run under Sruwaddacon Bay, in north Mayo. The tunnel will have an external diameter of 4.2m and an internal diameter of 3.5m and will run at depths of between 5.5m and 12m under Sruwaddacon Bay.

The building of the tunnel requires the use of a large tunnel boring machine (TBM).

“The Corrib tunnel will be the longest tunnel in Ireland and the longest gas pipeline tunnel in Europe.”

Paul Hughes, Tunnel Construction Manager, Shell E&P Ireland Limited
The Aughoose and Glengad Sites

Excavation of the tunnel is in one direction, starting at a launch shaft on SEPI owned land in the townland of Aughoose and running to a reception pit in Glengad where it will connect with the offshore pipeline.

The tunnel and the installation of the pipeline require the construction of two temporary compounds – the launch shaft site at Aughoose and the recovery shaft site at Glengad.

The compound at Aughoose contains all of the services and materials needed for the tunnelling process.

The TBM commenced excavation of the tunnel in early January 2013. The work continues 24 hours per day, seven days per week.

Environment

The compound was designed and constructed to minimise environmental impacts, particularly on Sruwaddacon Bay which is a designated conservation site, a candidate Special Area of Conservation (cSAC) and proposed Special Protection Area (pSPA).

Peat removed during construction was stored either on site or removed to the Bord na Móna peat deposition site at Srahmore, near Bangor-Erris.

All of the lower buildings have been painted green and taller structures are grey to reduce visual impact. Taller structures have been fitted with special lights for the protection of birds. The acoustic fence is one of the measures to reduce noise from construction activities. Surface water runoff is processed in a water treatment plant on site before being discharged into the bay.

“The tunnelling team is operating to extremely high environmental standards”

Carmel Carey
Environmental Advisor
Shell E&P Ireland Limited
The 4.9km Corrib tunnel under Sruwaddacon Bay is being built by a joint venture between BAM Civil and Wayss & Freytag, both operating companies of the Royal BAM Group.

BAM Civil (formerly Ascon) is one of the largest civil engineering and public works contractors in Ireland while Wayss & Freytag, one of Germany’s largest construction companies, specialises in the construction and development of tunnels using TBM’s. Founded in 1875, Wayss & Freytag has developed many of the techniques used today in tunnel construction worldwide.

This partnership brings together the vast tunnelling experience and expertise of Wayss & Freytag with BAM Civil’s expertise in civil engineering and its experience in the Irish construction industry.

“Working in the tunnel is challenging especially when temperatures reach over 35 degrees”

Thomas Healy
Segment Handler,
BAM Civil/Wayss & Freytag JV

Alex Schnabel
TBM Fitter, BAM Civil/Wayss & Freytag JV
The world's longest tunnel carries water 170km to New York City from the Delaware River in the United States.

The Channel Tunnel connects Great Britain to Europe through three, 50km long tunnels. 37km of this tunnel are underwater.

The largest Irish tunnel is the 4.5km Dublin Port Tunnel, which links the M1 and N50 motorways around Dublin.

A Brief History of Tunnelling

Tunnelling as part of major infrastructure projects has a long history. Early versions of the TBM were used to excavate the Thames Tunnel, London in the 1820s.

By 1870 tunnelling technology had already advanced for the construction of the Tower Subway under the Thames where a new design for a circular tunnel, which was both simpler in construction and better able to support the weight of the surrounding soil, was used for the first time.

The modern precursor of today's TBMs were developed for dam construction in the US in the 1950s and since then tunnelling has been a major part of the construction of transport, utility and energy infrastructure projects around the world.

The TBMs used in tunnel construction today are highly sophisticated machines that bring together the latest advances in safety, engineering and technology.
The TBM for the Corrib tunnel was designed and built in Schwanau, Germany, by Herrenknecht, one of the world’s largest makers of TBMs. The Corrib TBM took more than a year to design and build.

Tunnelling Traditions
Since medieval times St Barbara has been considered the patron saint of mining and then tunnelling. That tradition continues today and a small statue of the saint is placed at the entrance of tunnelling projects to provide good luck and safety during construction. According to tradition, all TBMs need a name before work begins, and, as with ships, the name must be female. The world’s largest hard rock TBM – with a diameter of 14.4m – was used to build the Niagara Falls Tunnel and was named ’Big Becky’. TBMs used in the construction of the Channel Tunnel were named ’Brigitte’, ’Europa’, ’Catherine’, ’Virginia’, ’Pascale’, and ’Severing’.

The Corrib TBM is 140m long, weighs almost 500 tonnes and comprises 14 sections.

The 28-tonne cutter head drills under the bay using a combination of cutter discs, scrapers and buckets and requires two 400kw motors to turn it.

Following in a long tunnelling tradition of naming TBMs, the Corrib TBM has been named ’Fionnuala’ after one of the Children of Lir, a legend closely associated with the Erris region.

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How Does the TBM Work?

The entire TBM comprises 14 trailers, including support and back-up services.

The cutter head at the front of the TBM breaks the rock, sand and gravel that it meets while tunnelling. This material is pumped in a suspended mixture back through the tunnel to the surface at Aughoose where it is later separated.

A naturally-occurring, inert clay called bentonite is used for lubrication and cooling of the cutter head, and to assist in the transportation of the arisings to the surface.

“The rock, sand and gravel is transported back through the tunnel for segregation at Aughoose”

Paul Kieran
Geotechnical Project Engineer - Shell E&P Ireland Limited
The TBM Operator

The TBM is controlled by an operator, who sits in a control cabin at the front of the machine. The operator’s role is to ensure the TBM stays on course. There are two other monitors on the surface to ensure the trajectory of the tunnel is correct, manual surveys are also conducted routinely. The TBM is kept on course by a laser guidance system which recalibrates itself every second to guarantee complete accuracy throughout the process.

How Does the TBM Work?

As the TBM moves forward, a series of 1.2m wide concrete rings made up of precast interlocking concrete segments is erected. These concrete rings, which are fabricated in Ireland, will eventually line the entire tunnel.

The cutting wheel/head rotates and as this happens hydraulic cylinders attached to the spine of the TBM propel it forward a few metres at a time.

Personnel, tools and materials, including the concrete segments, are brought from the tunnelling compound at Aughoose to the front of the tunnel using a small train.

Rene Pagel-Hanf, Shift Foreman, BAM Civil/Wayss & Freytag JV

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Maintaining the Tunnel

Some approximate measurements...

- 8 Crew members on the TBM (2x12 hour shifts)
- 4.9 Kilometres: the length of the tunnel
- 15 Tonnnes: of food and water consumed weekly
- 28 Tonnnes: the weight of the TBM cutter heads
- 60: the number of concrete ring segments erected each day
- 140 Metres: the length of the TBM
- 500 Tonnnes: the weight of the TBM
- 1,000 Litres: the amount of grease used weekly on the TBM

Michael Harpf, Tunnel Manager, BAM, Civil/Wayss & Freytag JV
Michael Arseand, Ring Builder, BAM, Civil/Wayss & Freytag JV
Frank Schwab, Locomotive Driver, BAM, Civil/Wayss & Freytag JV
“Tunnelling minimizes the impact on habitats and species in Sruwaddacon Bay”

Installation of the Pipeline and Reinstatement

Once the tunnel is completed, the 20-inch (50cm) diameter pipeline (which has a wall thickness of 1 inch) will be installed in it, together with a number of service and umbilical control lines. The pipeline and services are tested before the last stage in the process when the tunnel is backfilled with a grout mix of water, cement and bentonite to completely seal it. The finished pipeline is then ready to transport gas from the Corrib field, which is located 83kms offshore to the Bellanaboy Bridge Gas Terminal.

When the tunnel is completed, work will commence on the reinstatement of the Aughoose and Glengad sites. Site installations will be removed. The stored peat from Aughoose and the soils from Glengad will be used to reinstate both sites. The only above ground installations to remain will be the Landfall Valve Installation (LVI) in Glengad and the Bellanaboy Bridge Gas Terminal.
Above: The Corrib tunnelling team from Shell E&P Ireland Limited and BAM Civil/Wayss & Freytag Joint Venture