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natural gas

SECTION END
1. INTRODUCTION AND SUMMARY

1.1 INTRODUCTION

This document is the Plan of Development (the "Plan") for the Corrib gas field. It describes the Corrib gas field and how Enterprise Energy Ireland Limited ("Enterprise"), as Operator on behalf of itself and its co-venturers Statoil Exploration (Ireland) Ltd and Marathon International Petroleum Hibernia Limited, proposes to develop the field. The Plan should be read in conjunction with the following documents:

a) Environmental Impact Statement for the offshore system and pipeline;

b) Environmental Impact Statement for the Corrib gas terminal;

c) Application for a Foreshore Licence;

d) Application to Mayo County Council for permission to construct the terminal; and

e) Various reports on the geology, geophysics and reservoir engineering of the Corrib Field and adjoining areas which are held by the Petroleum Affairs Division of the Department of the Marine and Natural Resources;

The Plan provides information on the design, siting, construction, establishment, operation, decommissioning and removal of the Corrib production, processing and transportation facilities. It also presents Enterprise’s estimates of gas volumes and the expected production profile from the field and explains how these have been prepared.

Figures and most tables referred to in the Plan are located at the end of each section. A list of abbreviations used in the Plan and a glossary of certain of the technical terms used is given at the end of the Plan.

The Plan, together with the documents mentioned above, should provide all the necessary information to allow the Minister for the Marine and Natural Resources to evaluate the proposed development of the Corrib gas field and to assess its economic, social, safety and environmental implications.

1.2 LOCATION OF FIELD AND PETROLEUM LEASE

The Corrib Field lies in the Slyne Basin, about 90km off the coast of Co. Mayo, within Blocks 18/20 and 18/25 (Figure 1.1a).

Interests in Licence 2/93, Licence 3/94 and in the Corrib Field are as follows:

Enterprise Energy Ireland Ltd (Operator) 45.0%
Statoil Exploration (Ireland) Limited ("Statoil") 36.5%
Marathon International Petroleum Hibernia Limited ("Marathon") 18.5%

An application for a Petroleum Lease has recently been made by Enterprise on behalf of itself, Statoil and Marathon. The co-ordinates of the suggested Petroleum Lease are given in Appendix A (Table A1 and Figure A1).

1.3 HISTORY AND STATUS

The Corrib Field was discovered in 1996 by well 18/20-1 (P&A, gas shows). Since then four appraisal wells have been drilled on the Corrib Field (Figure 1b). All tested gas and all have been suspended for use as future producers.

An application has been made for a Petroleum Lease, as described above.

1.4 RESERVOIR GEOLOGY AND PETROLEUM ENGINEERING
1.7 FIELD DEVELOPMENT CONCEPT

Corrib will be developed as a subsea tie-back to a processing terminal onshore (Figure 1.4). It is expected that about seven subsea wells will be completed and tied back to a central gathering manifold which will connect to the main offshore pipeline. The offshore pipeline will carry gas from the manifold to the landfall at Broadhaven, Co. Mayo, and from there to the gas processing terminal. The terminal will be located near Bellanaboy Bridge in the townland of Bellagelly South (Figures 1.5 and 1.6). Gas will be exported from the terminal via a Bord Gáis Éireann (BGE) owned and operated pipeline to a tie-in at Craughwell near Galway.
The facilities incorporated into the subsea scheme will include:
- Subsea christmas trees;
- Subsea production chokes;
- Pressure and temperature sensors;
- Well gas flow meters;
- Manifold isolation valves; and
- A pig launching facility.

All subsea facilities will be controlled and monitored from the onshore gas processing terminal via an electro-hydraulic remote control system. Electrical power and signals, along with chemical injection fluids, will be carried in an underwater umbilical cable, laid on the seabed.

The onshore reception and processing terminal will comprise:
- Slug catching and separation facilities;
- Gas conditioning facilities;
- Sales gas compression;
- Fiscal metering and odourising;
- Hydrate and corrosion inhibitor storage and pumping system; and
- Supporting utilities including power generation and fire fighting systems.

1.8 PROJECT EXECUTION AND SCHEDULE

The Corrib Project is targeted to reach completion in January 2003 with the commencement of commercial gas sales. The key milestone dates are shown in Table 1.2 while the main activities are summarised in Figure 1.7. The schedule is described in greater detail in Section 4.3.3 and is shown in greater detail in Figure 4.10.

1.9 FIELD PRODUCTION: OPERATIONS AND MANAGEMENT

The Corrib Field will be developed with the objectives of maximising reservoir value and economic gas recovery whilst adhering to both the Enterprise Health, Safety and Environment policy (Section 8.1.1) and good and prudent oil and gas industry practice.

A philosophy of detailed data acquisition shall be adopted throughout future drilling activities and into the Corrib Field operational phase. The information gathered will be used to update both subsurface and reservoir models throughout field life.

The ability to collect accurate well performance data will assist in the minimum well intervention policy. No production logging is anticipated and it is unlikely that water shut-off programmes will be required.
The Corrib gas terminal will have the objective of supplying BGE-specification sales gas to the BGE transmission network. The overall control and monitoring functions shall be carried out by operations personnel based at the terminal with a remote (view only) link accessible to Dublin-based personnel. Gas conditioning and dewpoint control shall initially be achieved by means of Joule-Thompson (J-T) valve expansion. However in later field life this will probably be enhanced by the addition of a propane refrigeration plant. The project phase of both the subsea and terminal development are to be enhanced by the early inclusion of Operations personnel.

The offshore pipeline and terminal equipment integrity shall be ensured with the installation of safety shutdown and monitoring systems. These will include an Emergency Shutdown (ESD) system and a manually initiated blowdown system.

1.10 FACILITIES DECOMMISSIONING
Abandonment will be carried out in compliance with all relevant legislation and / or international agreements in force at the time of the end of the installations’ life. It is envisaged that a detailed abandonment study, encompassing total development infrastructure, will be carried out approximately five years prior to abandonment. All reasonable provisions will be made during the design, construction and operational phases of the development to facilitate end of life abandonment.

Abandonment considerations and constraints are discussed in the Environmental Impacts Statements prepared for the offshore and onshore elements of the project.

1.11 HEALTH, SAFETY AND ENVIRONMENT
Enterprise’s HSE policy is that, in so far as is reasonable and practicable to do so, the Company will conduct all its activities in such a way as to:

- Avoid harm to all personnel who may be affected by its operations;
- Minimise adverse effects of its operations on the environment;
- Seek progressive improvements in its health, safety and environmental performance;
- Comply with all applicable legislative requirements.

The overall health, safety and environmental goal for the Corrib development project is that the development and its associated activities shall not give rise to accidents, personnel injuries or ill health, or to material losses or damage to the environment.

To achieve the above, the Corrib facilities will be designed in accordance with relevant standards and codes. Hazards identification activities and Hazards and Operability Studies form integral parts of the engineering effort for the project, and will be conducted to cover design, installation, commissioning, start-up, normal operations and maintenance.
All activities shall be carried out in accordance with the requirements of the Safety, Health and Welfare at Work Act (1989) as amended. All contractors will be required to have a relevant safety statement covering their Corrib personnel and sites.

1.12 SOCIO-ECONOMIC IMPACT

The Irish natural gas market is growing rapidly, due principally to the increasing use of gas-fired power generation to meet the rapidly growing demand for electricity.

Demand for gas for power generation is expected to continue to grow as other less environmentally acceptable fuels are phased out, and to meet the continuing increase in demand for electricity. Further, in addition to the power generation market, organic growth in the demand for energy in Ireland in other areas is anticipated to continue rising.

As a consequence, from 2004 onwards, the projected annual demand for gas in Ireland will exceed that which can be supplied from the existing Kinsale area fields and via the UK/Ireland inter-connector which currently has capacity constraints at Moffat. Gas from Corrib will partially offset this anticipated shortfall.

Manpower requirements during the construction of the terminal will vary during the initial site preparation work, during construction and during normal operation. During construction, manning levels are expected to peak at around four hundred. Construction of the BGE owned and operated pipeline from the terminal to Galway will provide a large number of additional jobs.

The manning level at the terminal during normal operation is expected to be around sixty.

Under the EU Treaty of Rome, it is illegal for the Corrib co-venturers to discriminate in favour of any category of supplier. Enterprise Energy Ireland Limited is, however, working closely with Enterprise Ireland, providing it with details of the Corrib project and regular updates on its progress and programme in order to give Irish suppliers full opportunity to assess the business potential associated with the Corrib project.

1.13 NEARBY AREA POTENTIAL AND CO-ORDINATION
Figure 1.1  
a) Location of the Corrib Field and Licences 2/93 and 3/94  
b) Location of wells drilled on the Corrib Field
Figure 1.2 Geological model of the Corrib reservoir
Dry gas discovery
90km offshore
350m water depth
Project shown to be technically feasible but costly
Sanction end 2000
First gas early 2003

Figure 1.4  Diagram showing development concept
Figure 1.5  Map showing location of terminal (blue rectangle) and approximate location of pipeline from landfall to terminal
Figure 1.6 Conceptual 3D view of Corrib terminal
Table 1.1  Predicted P90, P50 and P10 sales gas production profiles
<table>
<thead>
<tr>
<th>Description</th>
<th>Milestone Date</th>
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</thead>
<tbody>
<tr>
<td>Completion of FEED and preliminary engineering</td>
<td>November 2000</td>
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<tr>
<td>Completion of Environmental Impact Assessment (EIA) and production of the</td>
<td>October – November 2000</td>
</tr>
<tr>
<td>Environmental Impact Statements (EIS)</td>
<td></td>
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<td>Award of Petroleum Lease by the Minister for the Marine and Natural</td>
<td>December 2000</td>
</tr>
<tr>
<td>Resources</td>
<td></td>
</tr>
<tr>
<td>Project Sanction by Boards of Enterprise, Statoil and Marathon</td>
<td>December 2000 to February 2001</td>
</tr>
<tr>
<td>Approval of Plan of Development by the Minister for the Marine and Natural</td>
<td>Mid January 2001</td>
</tr>
<tr>
<td>Resources</td>
<td></td>
</tr>
<tr>
<td>Award Main EPC Contracts for Terminal, Subsea Facilities and Onshore</td>
<td>February 2001</td>
</tr>
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<td>Pipeline</td>
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<td>Commence Terminal construction works</td>
<td>Q1 2001</td>
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<tr>
<td>Commence Onshore Pipeline construction works</td>
<td>Q1 2002</td>
</tr>
<tr>
<td>Commence Landfall works</td>
<td>Q2 2002</td>
</tr>
<tr>
<td>Commence Subsea Facilities and Pipeline Installation</td>
<td>Q2 2002</td>
</tr>
<tr>
<td>Mechanical Completion of all works</td>
<td>October 2002</td>
</tr>
<tr>
<td>Commence Commissioning</td>
<td>October 2002</td>
</tr>
<tr>
<td>Commissioning complete and First Gas Sales</td>
<td>January 2003</td>
</tr>
</tbody>
</table>

Table 1.2  **Key Milestone Dates**
SECTION END
2. HISTORY AND STATUS

2.1 LICENCE HISTORY, LICENSEES AND INTERESTS

The Corrib Field lies within Licences 2/93 and 3/94 (Figure 2.1).

Licence 2/93 was awarded in the 1993 Deepwater Licensing Round to a partnership comprising Enterprise Oil plc (60%; Operator) and Santa Fe (40%) while Licence 3/94 was awarded in the 1994 Frontier Round to the same partnership.

Subsequently, Enterprise cross-assigned 15% of their equity in the above licences with Statoil Exploration (Ireland) Limited for 15% of Licence 5/94. Santa Fe was purchased by Saga Petroleum in 1998, who then farmed-out 18.5% of their interest to Marathon Hibernia Limited in 1999. Saga Petroleum’s remaining interest was assigned to Statoil when Saga Petroleum was taken over by Norsk Hydro in late 1999. In early 2000, Enterprise Oil plc transferred all of its Irish licences into an Irish subsidiary, Enterprise Energy Ireland Ltd.

Current licensees in Licence 2/93, Licence 3/94 and in the Corrib Field are as follows:

<table>
<thead>
<tr>
<th>Licensee</th>
<th>Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Energy Ireland Ltd</td>
<td>45.0%</td>
</tr>
<tr>
<td>Statoil Exploration (Ireland) Limited</td>
<td>36.5%</td>
</tr>
<tr>
<td>Marathon International Petroleum Hibernia Ltd</td>
<td>18.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Two exploration wells (27/5-1 and 18/25-2) and one appraisal well (18/25-1) have been drilled in Licence 2/93 (Figure 2.2). One exploration well (the Corrib discovery well, 18/20-1) and three appraisal wells (18/20-2z, 18/20-3 and 18/20-4) have been drilled in Licence 3/94 (Figures 1b and 2.2).

Well 27/5-1 was the first well drilled by the partnership in the Slyne Basin, spudding in April 1996. This well encountered heavily oil-stained Middle Jurassic sandstones, as well as a good quality Sherwood Sandstone section. However, there were no live shows and the well was plugged and abandoned as a dry hole with oil shows.

Well 18/20-1 was also drilled in 1996, and was the first well in the northern Slyne Basin. It targeted a Middle Jurassic tilted fault block, with a deeper Triassic secondary objective. The well encountered good gas shows in the Triassic Sherwood Sandstone and minor dead oil shows in the Middle Jurassic. Due to the collapse of casing (caused by moving salt in the Mercia Mudstone group), the drill string test (DST) of the Sherwood was abandoned. The well was abandoned as a gas discovery with oil shows.

Four Corrib appraisal wells have since been drilled, all testing gas and all being suspended for use as future producers. Further information is given in the following section.
One further exploration well has been drilled in these Licences. This was well 18/25-2 which tested the Shannon prospect, a Triassic tilted fault block located approximately 10kms southwest of Corrib. Unfortunately, the Sherwood Sandstone was water wet and the well was plugged and abandoned as a dry hole.

2.2 FIELD HISTORY

The Corrib Field was discovered in 1996 by well 18/20-1 (P&A, gas shows). Four appraisal wells have since been drilled on the Corrib Field. These are as follows:

<table>
<thead>
<tr>
<th>Well</th>
<th>Date drilled</th>
<th>Status</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>18/20-2z</td>
<td>1998</td>
<td>Suspended gas well</td>
<td></td>
</tr>
<tr>
<td>18/25-1</td>
<td>1999</td>
<td>Suspended gas well</td>
<td></td>
</tr>
<tr>
<td>18/20-3</td>
<td>2000</td>
<td>Suspended gas well</td>
<td></td>
</tr>
<tr>
<td>18/20-4</td>
<td>2000</td>
<td>Suspended gas well</td>
<td></td>
</tr>
</tbody>
</table>

An application for a Petroleum Licence was made in December 2000.
2.3 COMMERCIAL AGREEMENTS

It is intended that a number of commercial Joint Venture agreements will be established between the three Corrib owners prior to first production. These will include the Field Operating and Services Agreement, the Terminal Operating and Services Agreement and the Gas Lifting Agreement.

2.3.1 FIELD OPERATING AND SERVICES AGREEMENT (FOSA)

It would be possible to operate the Corrib Field under the existing Licence 2/93 and Licence 3/94 Joint Operating Agreements (JOAs). However, it was decided that a Field Operating and Services Agreement (FOSA) should be put in place to cover not only the Corrib Field facilities in the new Petroleum Lease area but also the gas pipeline from the Corrib Field to the terminal.

The FOSA will replace the JOAs as far as operation of the Corrib Field area is concerned and will specify in greater detail than the JOA how the Corrib Field will be administered. It will define or establish procedures for addressing:

- The authorities and duties of the Operator;
- Rights of the participants;
- Budgetary and accounting procedures;
- Disposal of hydrocarbons;
- Shutdown planning;
- Third party use of facilities; and
- Decommissioning of facilities.

2.3.2 GAS LIFTING AGREEMENT

The gas lifting agreement will form an appendix to the FOSA. It will establish:

- To what degree each co-venturer can over-lift gas relative to a specified profile; and
- The mechanism by which any co-venturer that has under-lifted gas can make up under-lift.

The gas lifting agreement will ensure that at the end of economic field life all co-venturers have lifted gas in their equity proportions.

2.3.3 TERMINAL SERVICES AGREEMENT (TSA)
This will define or establish procedures for addressing how the terminal is managed and services are provided to the Corrib Field as the user group and in particular will cover:
- Services, scope and standard of performance;
- Capacity substitution rights;
- Entry and re-delivery specifications
- Throughput restrictions and emergencies; and
- Allocation principles.

2.3.4 TERMINAL OPERATING AGREEMENT (TOA)

This will govern ownership and operation of the terminal as between the Corrib owners as terminal owners and in particular will cover:
- Authorities and duties of the terminal Operator;
- Rights and obligations of the terminal owners;
- Costs and accounting procedures to be followed;
- Ownership of the terminal;
- Third party access; and
- Expansion rights.
Figure 2.1  Map of Licences 2/93, 3/94 and 5/94 showing location of Corrib Field
Figure 2.2  **Map showing location of exploration wells in Licences 2/93 and 3/94 and surrounding area**
natural gas

SECTION END
3. GAS INITIALLY IN PLACE, RESERVES AND PRODUCTION PROFILES