

2.6 Offshore Oil & Gas Research Programme

2.6.1 Introduction

Oil and gas continue to be a major component of the global energy portfolio, with 35% of global oil production and 27% of global gas production coming from the offshore sector. Although there have been small/moderate sized discoveries of gas in the Porcupine Basin and Celtic Sea, no Irish oil production has been achieved to date and none is forecast in the immediate future.

Ireland's offshore gas resources, however, currently supply about 22% of the economy's primary energy requirement (TPER) including generating about 55% of the electricity required. This places Ireland above the average in EU terms but well behind producer countries such as the Netherlands (47%) and UK (38%). Projections suggest that demand for gas will grow by over 75% in the period 2000–2015. Ireland has been a producer of offshore gas since 1978, with production coming from fields off the south coast at Kinsale, Ballycotton and Seven Heads fields. These resources are progressing towards depletion but new production is scheduled to come on-stream at the Corrib Field off the Mayo coast.

For the immediate future, Ireland is forecast to be a small producer of gas unless there are some major discoveries. This said, in 2003, gas production generated €115 million for Irish firms. Irish companies received €22m of the €350m worth of contracts awarded for the exploration and development of the Corrib Field, and Irish-based and Irish-owned companies supply some niche technologies to a number of key foreign markets.

Methane, occurring as a gas hydrate in deep marine sediments, is considered by many to be a strong candidate for a new energy resource and is currently the target of many international research programmes. Methane hydrate is stable in ocean floor sediments in water depths greater than 300 metres and at low temperature and is thought to be widespread in ocean sediments, including those off the Irish coast. Ireland is believed to have a major, but un-quantified, offshore methane hydrate resource that, given the appropriate extraction and utilisation technology, may be of future significance.

2.6.2 Sector Profile

Oil and gas exploration is a truly international activity dominated by multi-national Exploration and Production (E&P) companies and serviced by internationally trading contractors, often located far from the production fields, offering a full suite of services (including R&D). In the North-east Atlantic, Norway

and the UK are forecast to account for 86% of European E&P expenditure over the next five years, the remainder being mainly divided between Denmark, the Netherlands, Italy and Ireland. Offshore Europe is a mature region and is entering an irreversible long-term decline. However, there may be some significant discoveries, particularly along the under-explored Atlantic margin. Although capital expenditure is already seeing decline, operational expenditure will remain high for many years to come.

2.6.3 Key Opportunities and Challenges

An ability to fully assess and quantify the Irish oil and gas resource, and other non-renewables (e.g. methane hydrates), is fundamental. The data that are now available from the Irish National Seabed Survey (INSS) can contribute significantly towards this, although further surveying and data interpretation are necessary.

Promoting Ireland's deep Atlantic margin as a laboratory and testing ground for deepwater E&P technology will add value to existing marine and petroleum research programmes and create opportunities for SMEs and research institutes to win international business in the E&P sector. As the E&P sector is well supported by the oil majors, industry funded research programmes such as the Petroleum Infrastructure Programme (PIP) should be actively encouraged and should include core E&P research (evaluation, seismic interpretation, etc) and related down-stream (processing, storage, etc) and environmental protection aspects.

The utilisation of methane hydrate as an energy resource poses many technological challenges and opportunities, including:

- > Identification and quantification of the methane hydrate resource;
- > Extraction, storage (e.g. gas to liquid) and use as an energy source; and
- > Potential environmental issues – for example gas hydrates may cause landslides on continental slopes.

The ongoing development of the sector requires a clear government energy policy based on security of supply, competitiveness and environmental protection. This must include a transparent planning process that allows for public engagement on energy issues, a long-term vision on licensing and planning, and the opening of the gas market.

There are a range of Irish companies supplying services into the international exploration and production market; e.g. construction and engineering, power generators, environmental assessment, seismic interpretation and processing, on-line learning, precision engineering, and floating production systems design. These activities are not constrained by low levels of investment in Irish exploration activities. There may be opportunities to substantially increase participation by Irish manufacturing and service companies in the E&P market through strategic alliances and co-operative targeting of niche markets.

2.6.4 2020 Scenario

2020 SCENARIO

Key opportunities and challenges in oil and gas will vary depending on the amount of oil and gas discovered and developed in offshore Ireland over the coming decade.

In the event of several major oil and/or gas finds and with the Atlantic resource at our doorstep, Ireland could find itself actively involved in advanced engineering projects related to deepwater operations, sub-sea processing and floating production systems.

A more likely scenario, however, is that a smaller number of new finds will be made and the focus of research and development will be on efficient exploitation of existing oil/gas resources, the development of marginal fields, secondary market developments (storage, transportation, etc), and the development of niche services for international markets. The industry will operate to a high standard of environmental best practice.

By 2020, Ireland will:

- > Be an attractive location for research activities associated with the oil and gas environment. Strong, industry-led research programmes will have been established and interdisciplinary research teams will be focused on the development of niche expertise and participation in internationally funded collaborative programmes.
- > Have quantified its methane hydrates resource and be involved in international research programmes and collaborations to examine the opportunities and implications of exploiting this resource.

2.6.5 2013 Objectives

The following objectives have been identified as critical milestones to be achieved by 2013:

2013 OBJECTIVES

- 1 Achieve a high international profile for Ireland as an attractive location for offshore activities by developing a range of information products and services that build on the availability of data from the Irish National Seabed Survey.
- 2 Implement a strong, industry-led, targeted research programme.
- 3 Develop strong interdisciplinary research expertise in a range of niche areas.
- 4 Achieve a high standard of Environmental Best Practice.
- 5 Identify and quantify the Irish methane hydrates resource, and participate in international research programmes to examine the issues surrounding the exploitation of the resource.

2.6.6 RTDI Requirements/Key Outputs

The identified RTDI requirements and key outputs for delivering on the 2013 Objectives of the research programme are presented below.

Table 2.17 Research Requirements & Key Outputs for the Offshore Oil and Gas Sector (including gas hydrates) to 2013

Objectives 2013	RTDI Requirements	Key Outputs
<p>1 Achieve a high international profile for Ireland as an attractive location for offshore activities by developing a range of information products and services that build on the availability of data from the Irish National Seabed Survey.</p>	<p>> The frontier Atlantic margin region, which is currently the focus of most interest in Ireland, was surveyed during Phase 1 of the INSS. Available data can be used to derive products tailored to suit exploration (gas seeps, geohazard and stability assessments, e.g. gas hydrate extraction); field development (regional bathymetry, EIS, sea floor characteristics); refining seismic interpretation (lithology-controlled velocity pullup and pulldown); installation (stability, geotechnics, environmental); and rapid assessment techniques (data mining, classification)</p> <p>> Exploration data released by the Petroleum Affairs Division (DCMNR) will also be vital for many of these areas of research</p>	<p>> Demand led products & services</p>
<p>2 Implement a strong, industry-led, targeted research programme.</p>	<p>> Some of the key RTDI challenges, which could constitute a collaborative third-level/ industry research programme include:</p> <ul style="list-style-type: none"> • Reservoir modelling • Novel seismic imaging techniques in reservoir management • Wireless telemetry for well monitoring • Fibre optic communications for production control 	<p>> Supporting technologies relevant to the stage of development of the Irish offshore oil and gas sector</p>
<p>3 Develop strong interdisciplinary research expertise in a range of niche areas.</p>	<p>> Build up research teams & capabilities in:</p> <ul style="list-style-type: none"> • Seismic modelling and data processing • Metocean services • Sidescan sonar acquisition and interpretation • Refraction seismic acquisition and interpretation • Gravity and magnetic modelling • Fluid inclusion studies 	<p>> Research expertise and capability</p>

continued

Table 2.17 Research Requirements & Key Outputs for the Offshore Oil and Gas Sector (including gas hydrates) to 2013

Objectives 2013	RTDI Requirements	Key Outputs
4 Achieve a high standard of Environmental Best Practice.	<ul style="list-style-type: none"> > Understand and adapt best practice from the North Sea on relevant techniques and technologies for monitoring oil and gas exploration and production 	<ul style="list-style-type: none"> > Codes of practice for environmental monitoring and management
5 Identify and quantify the Irish methane hydrates resource, and participate in international research programmes to examine the issues surrounding the exploitation of the resource.	<ul style="list-style-type: none"> > Establish the location and quantity of gas hydrates in Irish waters > Assess environmental impacts of gas hydrate extraction/usage 	<ul style="list-style-type: none"> > Irish methane hydrates resource identified and quantified > Understanding of the environmental impacts of gas hydrate utilisation > Participation in international research programmes aimed at gaining a better understanding of the issues surrounding the utilisation of gas hydrates for energy supply

2.6.7 RTDI Capabilities/Capacity

Current Research Capacity

Third-level Sector

Five research teams in five third-level institutes are currently actively involved in offshore oil and gas research (Table 2.18). The research focus of these groups covers areas such as marine geology and geophysics, seismics, basin analysis and sedimentary geodynamics.

A further 6–8 research groups and a number of individual researchers (approximately 60 researchers in total) have relevant skills and research interests that could be applied to the future oil and gas RTDI requirements. These skills are applicable to such areas as environmental monitoring, marine robotics and advanced instrumentation and control systems.

Table 2.18 Overview of Current Offshore Oil and Gas Research in the Third-level Sector

Institutes	No. Research Groups	No. Researchers*	Research Focus
UCC	4 Large	22	<ul style="list-style-type: none"> > Marine geology and geophysics. > Petroleum geology. > Sedimentary geodynamics. > Marine seismics and basin analysis. > Marine electromagnetics. > Rheological and geodynamic modelling. > CO2 sequestration. > Hydrate and fluid inclusion.
TCD	1 Small		
DIAS			
UCD			
NUIG			

Large: >10 researchers; Medium: 5–10 researchers; Small: <5 researchers

* In some cases, research groups may focus on more than one theme and the total number of researchers in these groups is greater than indicated here. The total number of researchers in the groups identified is approximately 55–60.

State Sector

Since the inception of the Irish National Seabed Survey (INSS), the Geological Survey of Ireland (GSI) and the Marine Institute have built up considerable seabed mapping expertise, e.g. in geophysics, hydrography and data management. At present, there are approximately 20 staff (Geological Survey of Ireland, Marine Institute and external contractors) involved in seabed mapping in Zone 2 (50–200m water depth) of the INSS. Many of these personnel have capabilities that can contribute to achieving the 2013 Objectives for the oil and gas sector.

The Petroleum Affairs Division (PAD) of the Department of Communications, Marine and Natural Resources, is responsible for the promotion, regulation and monitoring of oil and gas exploration and development and has expertise in seismic surveying, seismic data interpretation and petroleum geology. The division identifies areas with potential, preparing interpretative reports and releasing basic geological, geophysical and well data to the industry. PAD administers the Petroleum Infrastructure (research) Programme (PIP), which is designed to promote hydrocarbon exploration and development activities by funding research data gathering and land-based research in Irish offshore areas, and provide a forum for co-operation amongst exploration companies and researchers. Close co-operation also exists between the GSI and PAD/PIP on the use of National Seabed Survey data in regional studies.

Industry

The oil and gas industry carries out considerable research and innovation in support of its activities. This research is difficult to quantify given the irregular nature of exploration by licence-holders. In addition, the industry funds third-level research via financial support to the PIP.

Apart from direct industry involvement in research and innovation, a small number of consultancy firms and individual consultants provide services to the oil and gas industry and participate in research, e.g. work carried out under the PIP. This expertise can contribute towards achieving the 2013 Objectives set out above.

Identification of Research Skills/Competencies to Meet Future RTDI Requirements

A summary, based on the identified future RTDI requirements, of the competencies required to meet the 2013 Objectives is presented in Table 2.19. Also included in Table 2.19 is an assessment of whether there are current strengths (S), areas that require strengthening (R), or gap areas (G), in relation to the identified requirements, within the existing research community.

Table 2.19 Competencies Required to Meet Future Research & Innovation Requirements for the Oil & Gas Sector

Objectives 2013	Competencies Required	Assessment
1 Achieve a high international profile for Ireland as an attractive location for offshore activities by developing a range of information products and services that build on the availability of data from the Irish National Seabed Survey.	> Hydrography	R
	> Seismic modelling	R
	> Offshore engineering	G
	> Data mining	G
	> Environmental impact assessment	S
	> Geotechnics	R
	> Ocean modelling	R
2 Implement a strong, industry-led, targeted research programme.	> Reservoir modelling	G
	> Novel seismic imaging	R
	> Wireless telemetry	S
	> Fibre optic communications	S
	> Drill-bit design	G
	> Robotics	S
3 Develop strong interdisciplinary research expertise in a range of niche areas.	> Seismic modelling	R
	> Metocean services	R
	> Sidescan sonar acquisition and interpretation	R
	> Refraction seismic acquisition and interpretation	R
	> Gravity and magnetic modelling	R
	> Fluid inclusion studies	R
4 Achieve a high standard of Environmental Best Practice.	> Environmental monitoring	R
	> Development of management systems/codes of practice	R
	> Advanced monitoring technologies (incl. remote monitoring)	G
5 Identify and quantify the Irish methane hydrates resource, and participate in international research programmes to examine the issues surrounding the exploitation of the resource.	> Seismic modelling	R
	> Environmental impact assessment	S

* S – Current Strength; R – Requires Strengthening; G – Gap Area.

Clearly, the majority of competencies required to meet the 2013 Objectives require strengthening or they are considered gap areas in the available research expertise. The research strengths that exist in relation to the 2013 Objectives for the oil and gas sector are not specific to the sector, e.g. they apply equally well for other research programmes. These strengths relate primarily to the delivery of Objective 2 (creating a strong industry-led interdisciplinary research programme in a range of niche areas).

Delivering products and services to the oil and gas sector in support of Objective 1 relies, largely, on maximising available data from Phase 1 of the INSS. The expertise to interpret and utilise these data (e.g. hydrography, ocean modelling and seismic modelling) requires strengthening. The expertise in survey

data acquisition built up over the course of the INSS (in the Marine Institute, GSI and third-level sector) can contribute significantly to Objective 3. However, expertise in seismic and sidescan sonar data acquisition requires strengthening and there are gaps in the available expertise to process, interpret and model such data. These gaps have implications also for the achievement of Objective 5 (identification and quantification of offshore methane hydrate resources).

Finally, the development of the oil and gas sector will require the highest standard of environmental best practice (Objective 4). Although there are current strengths in the generic area of environmental impact assessment, the adaptation of this expertise to the oil and gas sector and expertise in environmental management systems and codes of practice for monitoring/management require strengthening.

Current Strengths	Require Strengthening	Gaps
<ul style="list-style-type: none"> > Wireless telemetry > Fibre optic communications > Robotics > Environmental impact assessment 	<ul style="list-style-type: none"> > Hydrography > Seismic modelling > Novel seismic imaging > Geotechnics > Ocean modelling > Metocean services > Sidescan sonar acquisition and interpretation > Refraction seismic acquisition and interpretation > Gravity and magnetic modelling > Environmental monitoring > Development of management systems/codes of practice > Fluid inclusion studies 	<ul style="list-style-type: none"> > Reservoir modelling > Data mining > Advanced monitoring technologies > Offshore engineering > Drill-bit design

Figure 2.16 Research Competencies Required to Meet 2013 Objectives for Offshore Oil & Gas (including Gas Hydrates)

2.6.8 Prerequisites for Achieving Objectives

The non-renewable energy sector (oil, gas, methane hydrates, etc) is governed by international markets and energy prices, and is dominated by multinational Exploration and Production companies. It is serviced by internationally trading contractors, sometimes owned by the multinationals, which offer a full suite of services, including R&D, and are invariably located far from the producing fields.

Success in achieving the stated objectives depends largely on the availability of indigenous energy resources and the attractiveness of Ireland to Multinational Corporations (MNCs) as a base from which to carry out R&D. Clearly, Ireland cannot hope to be a leading R&I performer unless there are major future finds, but can aspire to developing niche knowledge-based specialities and capabilities.