Prospectivity of the Slyne Basin

Petroleum Exploration Licence 1/06 (Frontier), Atlantic Ireland
Why Explore in Ireland?
Commercial Factors

- Highly under-explored
- Big market for domestic production
- Good onshore Irish gas distribution network
- Access to European markets via UK interconnector
- Stable politically and economically
- Very favourable corporation tax regime

**Exploration & appraisal Wells drilled in offshore Ireland per year**
(source: PAD / Wood MacKenzie)

- **Kinsale Head Discovery** (1978)
- **Corrib Discovery** (1996)
- **Doolish Discovery** (2002-3)
- **Bandon Discovery** (2009)

**Ireland gas consumption** (projected to 2020)

- Corrib gas assumed from 2014
Why Explore Ireland Atlantic?
Geological Factors

- Shared geology with UK, Faroe & Norwegian Atlantic margins
- Numerous rifted basins
- More than one proven play
- Six oil and gas fields / discoveries
- Numerous reservoirs & seals
- Several proven source rocks
- Many large undrilled structures
Why Not Explore Ireland Atlantic?  
Debunking the Myths…

- Herd instinct
  - The herd is (mostly!) grazing around Africa

- Perceived lack of exploration success
  - Irish Atlantic is similar to the UK & Norway in terms of drilling success rates

- Lack of geological understanding
  - Diverse geology, similar to other proven North Atlantic Margin basins

- Hostile operating environment
  - Similar to other North Atlantic basins; some plays are not in deep water

- Remote location
  - But potential for large hydrocarbon volumes is proven

- The “Corrib Factor”
  - False perception that Ireland is a difficult place to conduct E&P business
### Irish Atlantic Margin

**Many Diverse and Proven Plays**

<table>
<thead>
<tr>
<th>RESERVOIR</th>
<th>SOURCE</th>
<th>SEAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eocene</td>
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</tr>
<tr>
<td>Palaeocene</td>
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<tr>
<td>Upper Cretaceous</td>
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<tr>
<td>Lower Cretaceous</td>
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</tr>
<tr>
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<td>PROVEN</td>
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</tr>
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<td>Middle Jurassic</td>
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<td>Lower Jurassic</td>
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<td>PROVEN</td>
</tr>
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<td>Triassic</td>
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<tr>
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<td>none</td>
</tr>
<tr>
<td>Carboniferous</td>
<td>Probable</td>
<td>PROVEN</td>
</tr>
</tbody>
</table>

The map indicates numerous wells with reservoirs & shows but no discoveries. Darker shading represents proven areas.

(source: PAD / Ternan, 2006)
Irish Atlantic Margin
Proven Source Rocks & Hydrocarbons

Plate reconstruction, early Cretaceous (Barremian 130 Ma)

(After Spencer & MacTiernan, 2001)
Atlantic Margin Geological & Commercial Chance of Success (gCOS & cCOS)

Faroe-Shetland
102 wells
14 discoveries
6 fields
gCOS 18%
cCOS 6%

Møre - Vøring
65 wells
14 discoveries
1 field
gCOS 23%
cCOS 2%

Central Graben
856 wells
117 discoveries
125 fields
gCOS 28%
cCOS 15%

Rockall (UK/Ire)
17 wells
3 discoveries
0 fields
gCOS 18%
cCOS 0%

Slyne-Erris-Donegal
11 wells
2 discoveries
1 field
gCOS 18%
cCOS 9%

Porcupine
26 wells
3 discoveries
0 fields
gCOS 11%
cCOS 0%

• Despite very little drilling, Irish Atlantic gCOS comparable to UK and Norway Atlantic basins
Irish Atlantic Margin
Licence Activity 2013 to date

- Recent activity focused on un-proven parts of Porcupine Basin
- West African geological analogues and key players
- Proven plays further north receiving little attention to date

- Serica EL 1/06
- Cairn farm-in to Chrysaor licences FEL 2/04, FEL 4/08 & LO 11/2
- Kosmos farm-in to Antrim licence LO 11/5 (converted to EL 1/13; July 2013)
- Kosmos farm-in to Europa licence LO 11/7 (converted to FEL 2/13, July 2013)
- Atlantic farm-in to ExxonMobil & Sosina (Dunquin)
- Kosmos farm-in to Europa licence LO 11/8 (converted to EL 3/13; July 2013)
- Woodside farm-in to Petrel licence LO 11/4
- Woodside farm-in to Bluestack licence LO 11/3
- Woodside farm-in to Petrel licence LO 11/6

(source map: PAD 2013)
Petroleum Exploration Licence 1/06 (Frontier) Summary

- Low risk exploration, Slyne Basin, west of Ireland
- EL 1/06 operated by Serica (50%) in partnership with RWE
- Water depth ~200m
- Proven oil on block (27/4-1,1z Bandon Oil Discovery)
- Nearby commercial gas field (Corrib)
- Good quality Lower Jurassic and Triassic reservoir sandstones
- Boyne, Liffey & Achill prospects clearly defined on 3D seismic data
- Exploration upside in the event of success
Lower Jurassic reservoir sandstones sourced by Lower Jurassic oil shales

Proven by the Bandon Oil Discovery 27/4-1,1z

Triassic reservoir sandstones sourced by Carboniferous coals

Proven by the Corrib Field 40 kms to north
27/4-1, 1z Bandon Oil Discovery

- 27/4-1,1z drilled by Serica in 2009
- 38 m gross oil column in Lower Jurassic sandstones
- Oil-water contact 1091 mSS
- Triassic sandstone moderate quality but water wet
- Well sidetracked to obtain core & MDT oil samples
- 16 °API oil; biodegraded due to shallow depth
- Proven 12 mmbo in-place
- 27/4-1,1z has proven a new oil play
Boyne, Liffey & Achill Prospects

Top Lower Jurassic Depth Map

- Bandon Oil Discovery 27/4-1, 1z
- Boyne Prospect
- Liffey Prospect

Top Triassic (Sherwood Sandstone) Depth Map

- 27/4-1 dry hole at Triassic level
- Achill Prospect
- Boyne Prospect
- Liffey Prospect
Boyne Prospect: Trap

Top Lower Jurassic Depth Map

Top Triassic Sherwood Sandstone Depth Map

Proposed Well (offset)

Bandon Discovery

Boyne Prospect

Top Lower Jurassic

Top Triassic Sherwood Sandstone

Top Bajocian Limestone

Top Permian Halite

Top Carboniferous
### Lower Jurassic Reservoir

- **27/4-1,1z reservoir**: estuarine to shallow marine sandstones
- **Excellent core porosity and permeability**
- **Nearby well 27/5-1 encountered similar, slightly younger sandstones**

#### Core Logs
- **Mud Couplets**
- **Flaser bedding – Mud Drapes**
- **Dip Reversals**
- **Tidal Rhythmites/Bundles**

#### Core Porosity vs. Permeability

<table>
<thead>
<tr>
<th>Porosity (%)</th>
<th>Permeability (mD)</th>
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<tbody>
<tr>
<td>0</td>
<td>10000</td>
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<tr>
<td>0.01</td>
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<tr>
<td>0.10</td>
<td>10</td>
</tr>
<tr>
<td>1.00</td>
<td>1</td>
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#### Lithology

<table>
<thead>
<tr>
<th>Stage</th>
<th>Formation</th>
<th>Member</th>
<th>Lithology</th>
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<tbody>
<tr>
<td>Early Toarcian</td>
<td>Porree Shale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late Pliensbachian</td>
<td>Scalpa Sandstone</td>
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<td></td>
</tr>
<tr>
<td>Early Pliensbachian</td>
<td>Pabba Shale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late Sinemurian</td>
<td>Skuinnish Sandstone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Sinemurian</td>
<td>Upper Broadford</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hettongian</td>
<td>Lower Broadford</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**27/4-1z core porosity vs. permeability**
Triassic Reservoir

- **27/4-1** modest reservoir quality, comparable to the Corrib Field
- Nearby well **27/5-1** had excellent reservoir quality continental sandstones, again similar to Corrib

- **27/4-1** average porosity 13%;
- **27/5-1** average porosity (core) 23%
• Portree Shale Formation, Well 27/4-1,1z
• Lower Jurassic age
• Excellent oil source rock characteristics; immature at well location
Lower Jurassic Charge

**Transformation Ratio Map, Top Lower Jurassic**
- **Boyne Prospect**
- **Liffey Prospect**
- **27/4-1,1z**
- **27/5-1**
- Thick but immature Lower Jurassic oil source rocks
- Lower Jurassic source rocks eroded on flanks of basin

**Depth Map on Top Broadford Beds**
- **Boyne Prospect**
- **Bandon Oil Discovery 27/4-1, 1z**
- Well 27/5-1 on migration pathway; oil-stained Middle Jurassic sands

**Oil source kitchen**
Carboniferous Source Rock

Well 27/5-1

- Carboniferous coals, 27/5-1
- excellent gas-prone source
- immature at well location
Carboniferous Charge

- Transformation Ratio Map, Top Carboniferous
  - Achill Prospect
  - Boyne Prospect
  - Liffey Prospect
  - thick, but immature Carboniferous Coal Measures

- Depth Map on Top Sherwood Sandstone
  - dry hole at Triassic level: lack of closure / cross-fault leakage?
  - dry hole at Triassic level: leakage across fault to north?
  - 27/4-1.1z
  - 27/5-1
• Lower Jurassic reservoirs sourced by up-dip oil migration from source kitchen

• Concept proven by the Bandon Oil Discovery 27/4-1,1z

• Triassic reservoirs sourced by Carboniferous coals, via windows in Permian halite

• Concept proven by the Corrib Field 40 kms to north
Boyne, Liffey & Achill Prospects
Predicted vs. Actual Oil Gravities

Oil Gravity (API)

Depth (mSS)

27/4-1,1z Bandon OWC 1091 mSS 16 °API

Boyne & Liffey Prospects 1800 mSS predicted 30 °API (range 19 to 38 °API)

26/28-1 Connemara 32 to 38 °API

Achill Prospect predicted 45 °API (range 32 to 55 °API)
## Resource Inventory

<table>
<thead>
<tr>
<th><em>Resources</em></th>
<th>$P_{90}$</th>
<th>$P_{50}$</th>
<th>Mean</th>
<th>$P_{10}$</th>
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<tr>
<td>Boyne Jurassic</td>
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<td>31</td>
<td>45</td>
<td>96</td>
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<tr>
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<td>38</td>
<td>104</td>
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<tr>
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<td>58</td>
<td>313</td>
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<tr>
<td><strong>Total mmboe</strong></td>
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<td>200</td>
<td>433</td>
<td>1000</td>
<td>mmboe</td>
</tr>
</tbody>
</table>

*Resource estimates are based on latest Serica in-house interpretation*

- Boyne Prospect is ranked No. 1
- Boyne Prospect has highest chance of success
- Excellent trap definition and simple charge model
- Two proven, low to moderate risk hydrocarbon systems
- Well-defined structural prospects on high-quality 3D seismic data
- Reservoir potential at more than one level
- Boyne Prospect is ready to drill
- Total dry hole well cost ~ US$ 30 million (includes mob / demob)
Acknowledgements

With thanks to Serica Energy & RWE