Subsea technologies for MER UK
SUT, IMCA and the Hydrographic Society in Scotland

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Performance turned around

**UKCS context**

**Infrastructure**
- 10,000+ wells
- 250 fixed installations
- 389 producing fields
- 250+ subsea systems
- 3,000+ pipelines

**Production (boepd)**
- 2014: 1.42 million
- 2015: 1.57 million
- 2016: 1.63 million
- 2017: 1.63 million

**Production efficiency**
- 2014: 65%
- 2015: 71%
- 2016: 73%
- 2017: 74%

**Technical finding cost $/boe**
- 2014: 69
- 2015: 53
- 2016: 45
- 2017: 47

**Costs**
- Unit Operating Cost down by 1/3
- Average fallen from £19 per boe in 2014 to £12/boe in 2017
- Unit Development Cost down

**Supply chain**
- £27bn turnover
- c.40% through exports and supporting c.80% of UK oil and gas jobs

**Jobs**
- > 280,000 jobs in the UK
- Delivered through or supported by upstream oil and gas activity

**Exploration success rates**
- 2014: 69%
- 2015: 53%
- 2016: 45%
- 2017: 47%

**Development**
- 5.4bn boe in production or under development

**Resources**
- Produced: 44.1bn
- Remaining potential: 10bn

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**Project activity**

**Sanctioned FDP/FDPAs not yet in production**

- **WOS**
  - Clair Ridge
  - Clair Seg 1
  - Lancaster EPS
  - Alligin

- **NNS**
  - Mariner
  - Utgard
  - Orlando
  - West Brae
  - Ballindalloch
  - Garten
  - Penguins

- **CNS**
  - Montrose
  - Culzean
  - Shearwater
  - Chestnut

- **SNS/IS**
  - Fram
  - Buzzard Phase 2
  - Gannet E
  - Arran
  - Finlaggan
  - Britannia
  - Vorlich

**Contingent resources (7.4Bnboe, 2C)**

- **WOS**
  - 828
  - 1197

- **NNS**
  - 459
  - 443

- **SNS/IS**
  - 320
  - 245

- **CNS**
  - 1700
  - 974

**Vital considerations**

- Sustain and increase efficiencies
- Resolve misalignments (licensing, infrastructure)
- Engage supply chain – new commercial models
- Deploy enabling technologies

**Improved project outlook with 7.4Bnboe of further contingent resources**

- Sanctioned FDPs & FDPAs
  - 2017: 7
  - 2018 YTD: 13
  - 2018 Total Forecast: 15-25

- CAPEX (£ BN)
  - 2017: 0.7
  - 2018 YTD: 3.4
  - 2018 Total Forecast: 3-4

- Reserves (MMBOE)
  - 2017: 100
  - 2018 YTD: 401
  - 2018 Total Forecast: 450-500

- NPV10 (£ BN)
  - 2017: 1.1
  - 2018 YTD: 3.4
  - 2018 Total Forecast: c.4.5

The OGA does not provide endorsements or investment recommendations. Those projects listed above are not necessarily a definitive list and the locations are indicative.
Deploy best-in-class technologies for projects and operation

**Existing assets**

- Inspection drones
- Non intrusive Inspections
- Asset monitoring & data analytics

**New developments**

- **Tie back of the future**
  - System simplification
  - Plug-n-play
  - Re-usable

- **Standalone facilities**
  - Low Capex
  - Low Opex
  - Re-deployable

- Mechanical connectors
- Composite spoolable
- Low cost, reusable platforms
- Subsea Chemical injection
- Subsea power generation
- Unmanned buoys
- Versatile production units

**OGA expectations**

- Operators submit Technology Plans
- Well-identified asset needs
- Demonstrate use of appropriate technologies

**OGA Technology Insights – Industry learnings**

- Collaboration with OGTC
  - Joint plans and initiative to close technology gaps

**Work with the Industry**

- Technology gaps (top 20)
- Agreed with MER UK TFs

**Collaboration with OGTC**

- Joint plans and initiative to close technology gaps
- £180m Government funding
National Data Repository
A first for the UK

OGA led, backed by industry

New regulations for reporting, retention and disclosure

Open data model to fully exploit value
Collaboration Technology AI & machine learning

Improved knowledge
Data cleansed

Frontier basins research with academia

53M
Spatial server requests

700%
growth in server requests since OGA established

55k+
users

Rapidly growing use of data and significant future plans

View it
Map it
Chart it
Download it
Share it
Subsea technologies for UKCS

1. Metering and flow assurance
2. Cost efficient tie-backs
3. More capable subsea systems
4. Inspection & maintenance
5. Energy integration & transition
6. Surveys

Transformative subsea technologies, with significant digital content
Subsea metering to enable future developments – more and accurate real-time data

UKCS 350 marginal discoveries – 3.2bnboe opportunity

Multi-phase (subsea) flow meters

- MPFM for continuous and accurate well flow rate
- Critical for multi-field cluster developments
- Non-intrusive options

- Technology investment
- New TUV NEL centre in East Kilbride
- Heavy oil: 3-in-1 flowmeter with flowrate, density and viscosity
- Data analytics for improved accuracy and self calibration
- Data analytics for large data volumes
Cost efficient tie-backs

Potential tie-back distances (marginal fields)

Discoveries and infrastructure (eg. Scott-Piper-Claymore area)

Tie-back of the future

- Low-cost pipelines (e.g. spoolable, using composites, mechanical connectors)
- Subsea storage of chemicals and hydraulics
- All-electric subsea systems -- simpler trees and controls
- Fewer parts / greater reliability
- Reducing / eliminating umbilicals
- Subsea power generation
- Real-time monitoring from shore
- Moving towards autonomous systems

>70% of tie backs over medium to long distances – tieback efficiency will be key
More capable subsea systems

UKCS marginal field developments (350 discoveries)

- Subsea storage
- Modular bladder tanks, extended capabilities
- Subsea compression for remote field
- Combined with separation, processing, water handling
- Reduce topsides burden and allow access to export infrastructure
- Subsea HPHT – to meet field requirements (P, T) and lower cost of development
- Challenge: manufacture/install systems at lower cost
- Exploit data for more flexibility, self-diagnostic, and self-healing – lower Opex

UKCS marginal field complexity

- 33% of marginal resources are in complex reservoirs
- NPNT, Good permeability 67%
- HPHT 20%
- Thin, High water cut 6%
- Tight, Faults 7%

Improving subsea capabilities for more flexible and cost-effective developments
Digital technologies can transform how we manage assets.

Subsea inspection and maintenance

UKCS extensive infrastructure

Digitally-enabled asset management

- Digital certification ("from cradle to grave")
- Enhanced planning with ROV simulations and 3D visualisation
- Digital collaboration to track real time operations worldwide

- Non-intrusive inspections
- Subsea Digital Radiography mounted on ROV and/or AUV

- Monitoring of pipelines, risers, umbilicals using fibre-optic
- Real-time data, data analytics and predictive
- Self-diagnostic and self-healing systems (eg flow assurance)
### Energy integration

#### Southern North Sea energy industry footprint

#### Potential integrated concepts

<table>
<thead>
<tr>
<th>Activity</th>
<th>Schematic</th>
<th>Potential Applications</th>
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</table>
| Platform Electrification  | ![Platform Electrification Schematic](image1)  | • SNS: power existing gas hubs from nearby windfarms  
• WoS: use floating offshore wind to create ring main |
| Gas-to-Wire               | ![Gas-to-Wire Schematic](image2)            | • SNS and EIS: convert late-life infrastructure into offshore power generation |
| Power-to-Gas (H₂)        | ![Power-to-Gas (H₂) Schematic](image3)      | • SNS and EIS: use redundant infrastructure |
| CO₂ transport and storage| ![CO₂ transport and storage Schematic](image4) | • SNS and EIS: use redundant infrastructure |
| North Sea Wind Power Hub | ![North Sea Wind Power Hub Schematic](image5) | • Integrate UK offshore power and gas (including hydrogen) activities |

#### Value creation for the UK offshore industries
Surveys

Mature areas – infrastructure density

Frontier areas – difficult targets (eg. sub-basalt)

Geophysical and other surveys

- Ocean bottom nodes
- Full-azimuth – high resolution (eg. sub-basalt, sub-salt)
- Near infrastructure placement
- 4D seismic for improved recovery
- More autonomous and affordable nodes, using robotics and digital
- Sea-bed seismic sources (more environmentally friendly)

- Multi-discipline surveys using autonomous vehicles
  - Oil & gas
  - Engineering
  - Environmental

More affordable and effective surveys – greater volumes of data
THANK YOU