Oil & Gas Authority

technology leadership board

UKCS Technology Leads Network

Second meeting – 4th October 2018

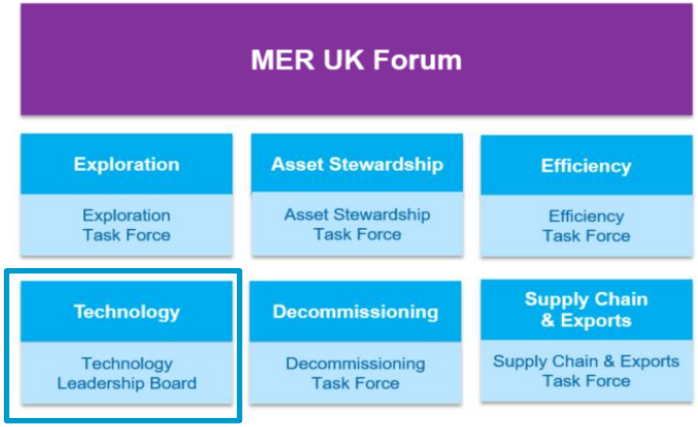
OGA offices – Aberdeen and London

Second UKCS Technology Leads meeting
October 4th, OGA, London and Aberdeen

- Welcome
- Safety brief
- Introductions

TLB update

- Meeting on September 12th 2018
- Work on strategic priorities in technology nearly completed
- 10 themes from Exploration to Decom - discussed with this group in July
- Back to MER UK Task Forces: Detailed definitions and industry ownership



- TLB strategy presentation at ENGenious (Bill Dunnett)
- Technology deployment and uptake
- Technology development to address priorities for the medium term
- Deployments and developments driven by strong business cases

Technology Leads Network – Your feedback in July

- Discuss needs - influence industry priorities
- Share experience on technology deployment
- Increase visibility on development and trials
- Network with peers and increase industry collaboration

- Open discussions
- Topics that do not raise confidentiality and competition concerns

Agenda

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0. Update after the last TLB meeting (Carlo Procaccini)
1. Industry Technology Plans – 2018 Insights (Malcolm Stone)
2. In-depth: Technologies for Facilities Management
    - Deployment experience, benefits and lessons learned
    - Emerging technologies, development and pilots
    - Chrysaor (Scott McCrorie)
        - Real time asset monitoring
        - Wearable and wireless technologies
    - Repsol (Darren Stoker)
        - Asset integrity digitalisation
    - Shell (Duncan McMillan)
        - Insulative coatings
        - Robotic surface preparation
        - Hydrophobic barriers
    - OGTC (Rebecca Allison) & Total (Dave MacKinnon)
        - Non-intrusive inspection
3. Closing – Comments (All)

1. Industry Technology Plans – 2018 Insights

UKCS operators' plans

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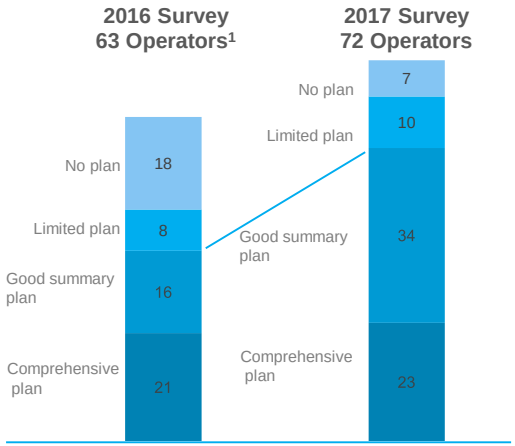
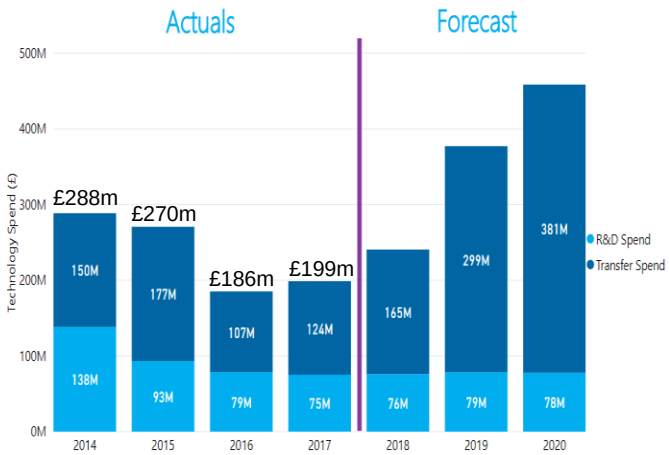
Operators' Submissions



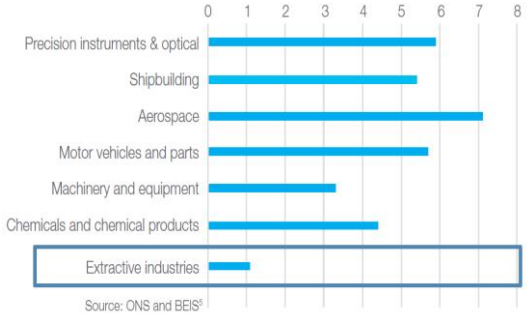
Source: OGA 2016 & 2017 UKCS Stewardship Survey

Note 1: out of 68 eligible, 5 did not submit

Technology Spend (£m)



Industry R&D spend - % of sales income



UK industrial manufacturing sectors (average 2014-2016)

2017 changes:

- 5 new operators (also PE-backed) growing their portfolios through M&A
- 3 operators exited the UKCS
- 100% response rate to the 2017 Survey

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Technology trends

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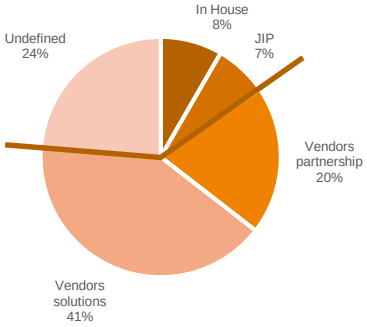
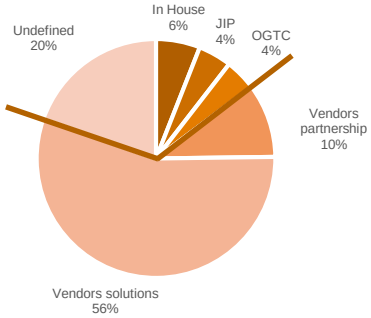
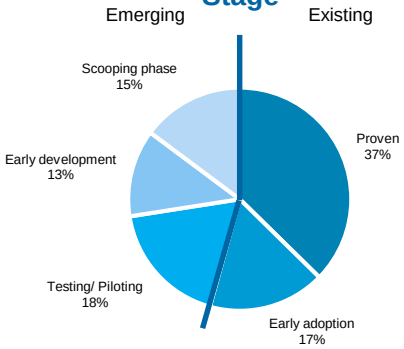
2016 Delivery Approach



2017 Delivery Approach



2016 Technologies by Maturity Stage



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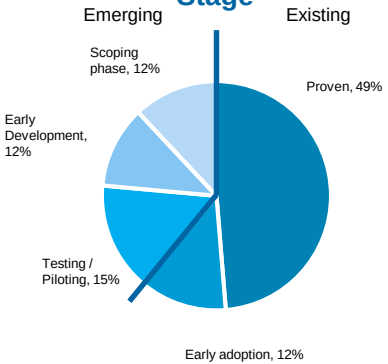

Comments

Existing technologies cover majority of asset needs

Companies should deploy

New technologies can further support achievement of MER UK

Companies should consider collaborating in R&D and piloting

OGTC is providing key support

OGTC:
Launched in February 2017

Over 100 projects approved, 37 supporting asset integrity challenges

Membership close to 100 companies

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Technology plans

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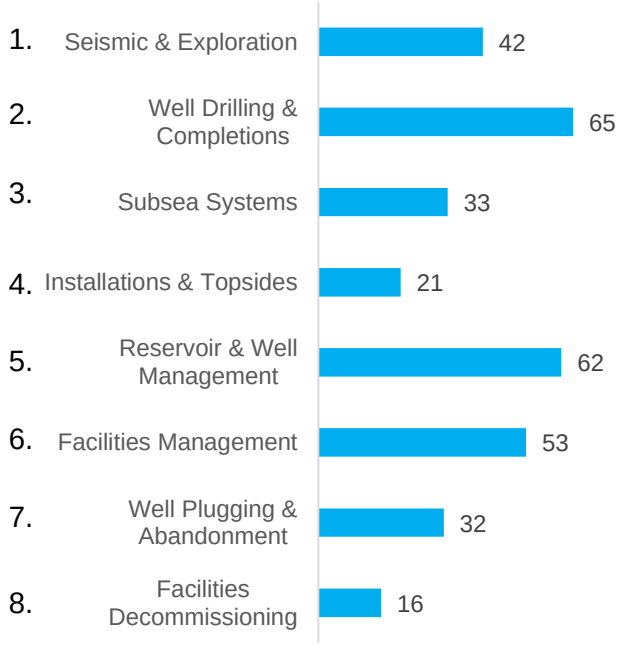
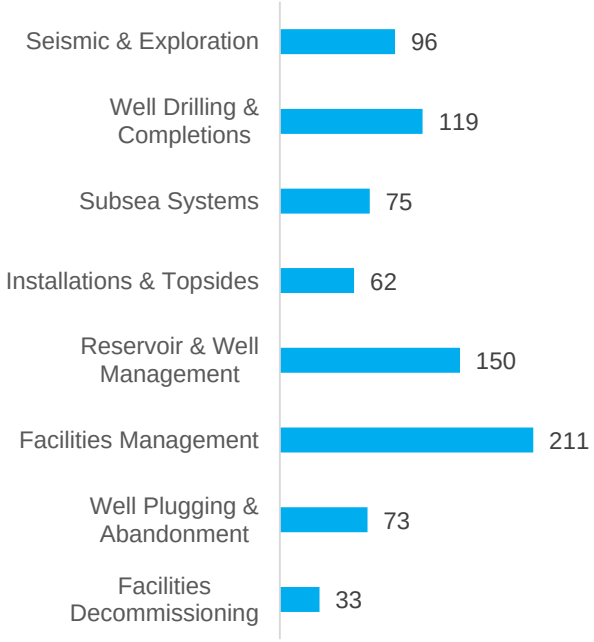
2016 Technologies in Operators' Plans (Total = 324)



2017 Technologies in Operators' Plans (Total = 819*)



* Not removing duplications

Comments

On aggregate, operators technology plans cover the whole life cycle from exploration to decommissioning

Content broken down into eight 'domains'

Individual operators have strengths and opportunities which vary by domain

There is a lot of value in sharing learnings

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Technology appetite high

6. Facilities management

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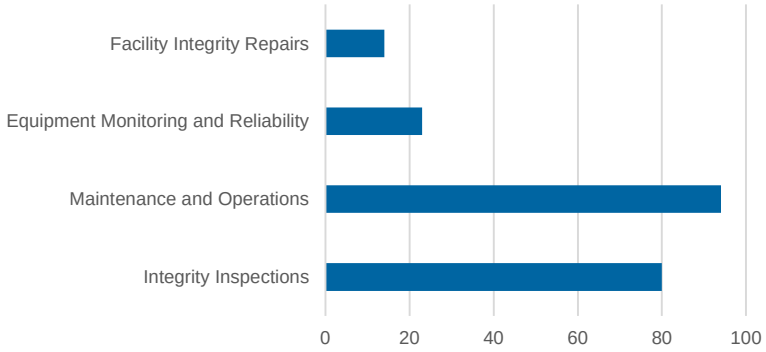
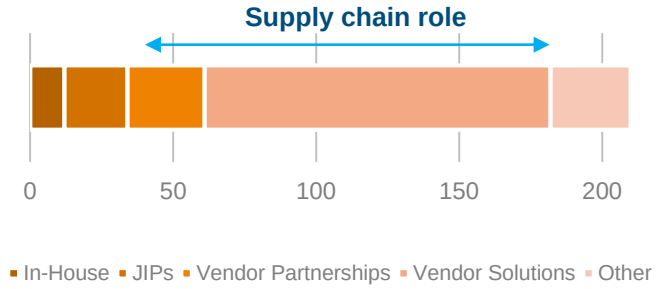
Sub-domains



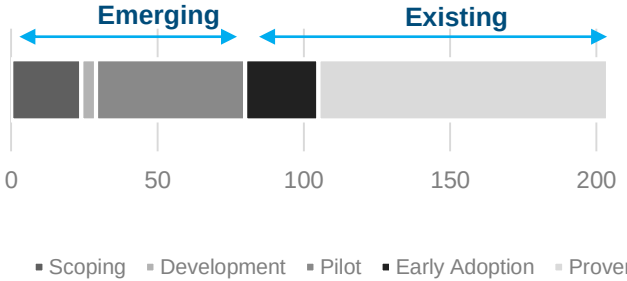
Key insights

- Continued investment in technologies supporting asset life extension and delivering Opex benefits
- The majority of technologies are developed by vendors, or in partnership with vendors
- Many technology solutions are available ‘off the shelf’ or ready to be deployed
- There is a healthy pipeline of supporting technologies under development
- There are clear opportunities for piloting and trailing new and emerging technologies

Approach



Maturity



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Technology plays a key role in facilities management

6.1 Facilities management

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Existing technologies – main areas of focus in operators' plans

Areas	Technologies
Wearable & wireless technologies	• Wider 4G coverage (Tampnet) • More devices ATEX rated (many vendors) • Body-mounted cameras, mobile data/communication (5+ operators)
Hard-to-reach area inspections	• Drones (10+ operators), splash zone and subsea crawlers (Chrysaor, Shell, Dana, Repsol, CNR) • Visual (10+ operators), FLIR (Repsol, BP, Enquest, Shell, Spirit), CT pipeline scanner (Shell, Repsol)
Composite repairs	• Fabric repairs (10+ operators) • Structural repairs (Repsol, Nexen, Conoco, Shell) • Splash zone and other harsh areas (Shell)
Corrosion detection & monitoring	• Detection - ultrasound (thickness), pulse-eddy current (flaws), x-rays (internal) (20+ operators) • Monitoring (Shell, Chevron)
Real-time asset monitoring	• CBM rotating equipment (5+ operators) • Subsea electrical fault finding (BP, Marathon, Shell, Total) • Onshore virtual centres (5+ operators)
Digital surveying	• 3D asset surveying – photogrammetry and laser scanning (10+ operators), including subsea (Shell), point & shoot survey (Shell)

Transferrable experience

Wearable cameras and communication (voice / visual / data)

- Operators Repsol and Chrysaor have deployed on brownfield assets
- Increasing service level operations from supply chain
- Delivering Opex efficiencies, safety improvements and supporting asset life extension

Drones for hard to reach areas

- Operators Anasuria and Total have deployed on FPSOs and complex manned assets
- Can be combined with different cameras (e.g. FLIR) and sensors
- Supply chain integrating data collection and analysis processes
- Delivering Opex efficiencies, safety improvements and supporting asset life extension

Integrated operating centres

- Operators like Chevron, Repsol, Conoco and BP deployed on their asset portfolio
- Integrated with vendors systems
- Increase uptime, optimise production, enhance safety and reducing Opex

6.2 Facilities management

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Emerging technologies – main areas of focus in operators' plans

Technologies	Value
Non intrusive inspections	• On-line vessel/tank inspection without entry - ultrasonic corrosion mapping, time of flight diffraction (5+ operators, OGTC) • Corrosion detection without insulation removal, enhanced/pulse-eddy current (Repsol, Nexen, Chrysaor, CATs, Taqa, OGTC)
Autonomous and robotic systems	• Beyond line of sight drones (Spirit), robotic arms, autonomous multitasking robots (Total, Shell, Chevron, OGTC), • Autonomous drone external corrosion survey (BP) • AUVs for subsea inspection and monitoring (Shell, Repsol) • Marinizing more inspection & detection tools (Total, Repsol)
Corrosion prevention	• Live-line and surface tolerant coatings, protective and self healing coatings, hydrophobic and free draining coatings (CATs, Centrica Storage, Chevron, Repsol, Shell) • Flange and bolt protection (Shell, Chevron, Nexen, CATs, Shell)
Predictive maintenance	• 'Health and Usage Monitoring Systems', digital analytics (5+ operators) • Vibration analysis cameras (Apache)
Additive manufacturing	• Offshore component manufacture (Shell, Total)

Key experience

Non-intrusive inspection
- Total and the OGTC completed three on line field trials on the Elgin Franklin platform
- Support and engagement from the supply chain to support trials.
- Results correlated with traditional techniques, with no downtime or safety challenges providing the potential to deliver Opex efficiencies and safety improvements.

Autonomous and robotic systems
- Total and the OGTC trailing autonomous robot at the Shetland Gas Plant, prior to offshore trial.
- Technology development has transferred from academia, into manufacture and real world trialling.
- Opex and Capex efficiencies and asset life extension..

Corrosion Prevention
- Total (Elgin-Franklin) and Nexen trial of EonCoat on aging assets. Shell use of hydrophobic barriers on Shearwater and Nelson
- Supply chain transferring technology from other sectors (Downstream)
- Delivering Opex efficiencies and supporting asset life extension

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4.1 Installations & Topsides

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Existing technologies – main areas of focus in operators' plans

Areas	Technologies
Fluids treatment and processing	• Small scale Separation process for out of spec water (Spirit Energy) • Treatment • Efficient gas/oil separation prior to transporting oil in pipelines (Total) • Simplified separation and dehydration scheme on Bentley (Whalsey Energy) • Separation technology for high water cut application (Perenco) • Multiphase booster compressor for gas and liquids to minimise system complexity (ONE) • Napthenate control using wash tanks • Compact produced water treatment for NUIs (Alpha Petroleum & INEOS)
Control and Automation	• Full remote control and automation capability via satellite on Solan field (Premier) • Platform automation (Total)
Flow measurement & metering	• Virtual metering (Apache) • Upgrade of existing meters to Ultrasonic meters (KNOC) • Enhanced water treatment using centrifuge technology (Perenco)
NUI Technology	• Low cost NUI facility in SNS (IOG) • Remote monitoring and control systems • Automation and remote monitoring to enable conversion of existing facilities towards NUI status in SNS (Premier) • Suction pile mono pod NUI application (KNOC)

Transferrable experience

Compact Water Treatment
- Alpha Petroleum Kilmar platform in SNS used a compact water treatment package following greater than expected water production
- Lack of deck space, platform weight and crane lifting restriction required a novel solution.
- The technology demonstrated that compact low cost water treatment solutions can be installed on unmanned platforms

Low Cost Platforms
- Efficient NUI concept used by ONE in Dutch Sector of SNS
- Modular re-usable system with 3 well slots and future tie-in capability provides low cost platform option for water depths up to 55m.
- Platform generated local power through platform mounted wind turbines and solar panels demonstrating that novel approach.

Facilities Upgrades
- Existing facilities are often challenged by limitations on deck space and weight to accommodate upgrades.
- Repsol-Sinopec used a suction pile monopod as a low cost alternative to an adjacent standalone platform. A monopod system was used on Britannia platform UKCS. Such technology offers opportunities for efficient upgrade for other UKCS platforms.

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4.2 Installations & Topsides

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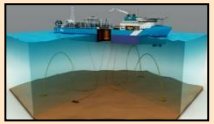
Emerging technologies – main areas of focus in operators' plans

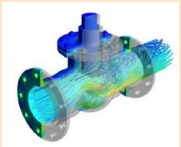
Areas	Technology focus areas
Heavy Oil	• Offshore steam to improve recovery of heavy oil discoveries (Pharis-Energy) • High temperature safety valve, flow control devices and non condensable solvent injection with steam (Pharis-Energy) • Compact processing technologies for heavy oil streams (Equinor)
Metering	• Non intrusive flow measurement devices • Accurate multiphase heavy oil metering (Equinor) • High accuracy gas metering (Centrica) • Testing of new topsides and downhole metering concepts (Equinor)
Flow Assurance	• Napthenate control using wash tanks (Total) • Inlet and outlet gas quality spec through use of advanced algorithms
Facilities	• Unmanned developments for small fields (Parkmead) • Mini FPSO solutions (Sumitomo) • Enhanced turret systems and polyester mooring lines (Chevron) • Low cost HPHT wellhead platforms (Total) • Low cost subsea systems and platforms for shallow water • Re usable suction pile jackets
Processing	• Gas to liquids technologies (Spirit Energy) • Technology for extracting energy from waste water • Inefficient condensate recovery through continuous separation and automation (Spirit Energy) • Natural gas processing through new membrane technologies

Technology Maturity



Novel Floating Facilities
- Range of novel floating concepts being progressed particularly with marginal discoveries in mind
- OGTC 'Facility of the future' initiative underway to explore pushing the boundary of unmanned floating facilities

Metering
- Non-intrusive flowmeter using piezo-electric transducers. Trialled onshore with view to offshore field trial.
- Non intrusive multiphase flow measurement device using laser technology and machine learning. OGTC supported project and currently undergoing calibration trials to ready system for commercial deployment



Heavy Oil
- High temperature downhole safety valve to enable offshore steam flooding project being supported by OGTC
- 3 in 1 heavy oil flowmeter with real time flowrate, density and viscosity capability. Currently at development stage with OGTC support

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Technology plans

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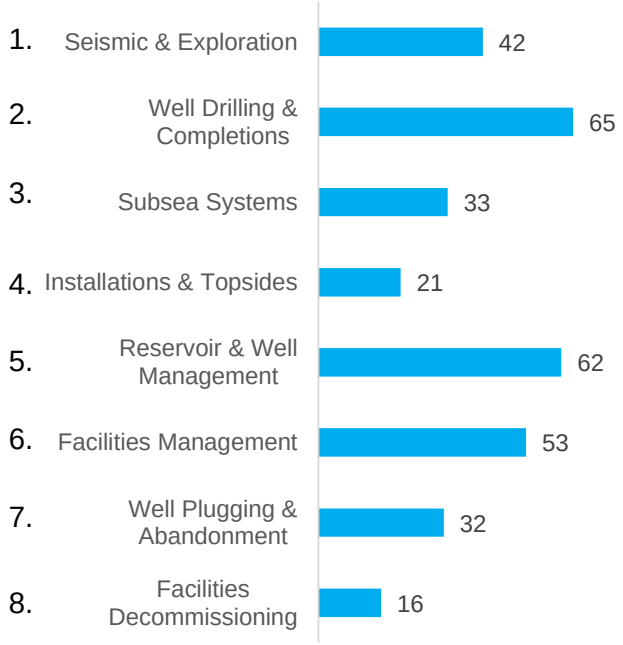

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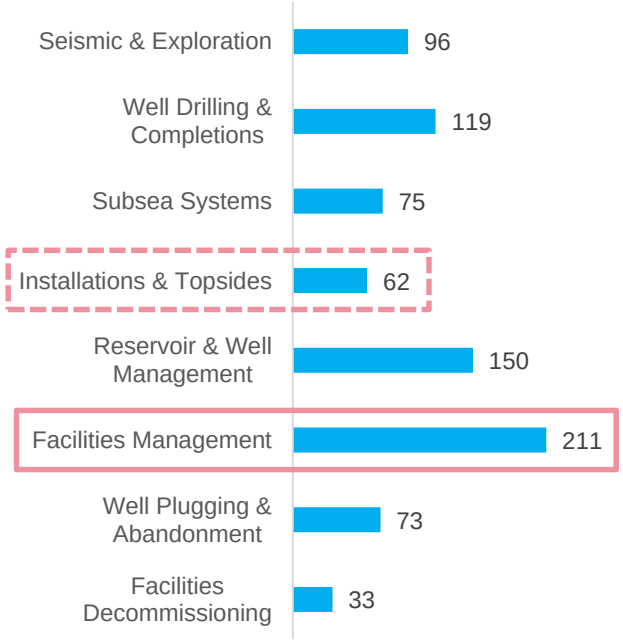

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