Reducing The Levelized Cost Of Energy Through Client-Focused Innovation

Keith McDermott, Ecosse Subsea Systems
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Looking to Reduce LCOE

Trouble with Boulders?

Generalists Vs Specialists

High Risk Cable Installation Methods?

Too Many Tiers in the Supply Chain?

Risk of Cable Damage During Installation?

Looking to Reduce LCOE?

Lack of Project Control?

Risk of Cost Escalation?

Struggling to Keep the Project Schedule on Track?

Tools on Downtime Due to Weather?

Slow and Unreliable Trenching Tools/Methods?

Lack of Innovation in the Supply Chain?
Its Time to Think Differently

- Reduced Risk
- Reduced Cost
- Increased Flexibility
Building a culture around Client-driven innovation through challenging the accepted norm has been the driving principle behind Ecosse Subsea Systems (ESS) "...Because we think differently" is the embedded ethos through which a range of patented and patent-pending technologies have flourished.
A key component of the ESS product development process is early engagement with project owners.

During such discussions, one message has been clearly and consistently conveyed – the cost of producing renewable energy must come down.

As a supplier of key subsea services within the infrastructure installation framework, ESS have responded by investing heavily in the innovation of tooling and methodologies with a view to contributing towards a reduced Levelized Cost of Energy (LCOE).
Innovative Technologies to Reduce LCOE

• ESS believe that project owners can reduce their LCOE through focusing on three primary areas – reducing risk, reducing cost and increasing flexibility.

• Our significant and recent project experience in Europe has proven this is achievable by adopting an alternative strategy towards offshore installation activities.
Innovative Technologies to Reduce LCOE

• The SCAR Seabed System fully encapsulates the above by offering a compelling alternative to many of the traditional trenching methods currently adopted on offshore wind farms.

• SCAR is a fully modular and field tested plough trencher which offers an extremely robust and cost-effective option for low-risk, high productivity cable and pipeline protection.

• The system in its various configurations offers a complete product protection solution spanning from site investigation and route preparation through to trenching and backfill. The driving force that inspired the design was a “back to basics” philosophy, brought about from unparalleled experience in trenching coupled with frequent observations of over-engineered and under-performing products.
By remaining focused on the key design philosophies of safe, simple and robust whilst actively engaging with developers at the construction planning stages, ESS have succeeded in significantly reducing the risks and costs typically associated with a range of subsea processes including product installation and subsea lifting.
Innovative Technologies to Reduce LCOE

SCAR Seabed System
Innovative modular trenching and seabed preparation system designed to reduce risk and product installation costs. SCAR can be deployed in its four primary modes: Boulder Clearing, Pre-Cut Trenching, Backfill and SUST (SCAR Uninterrupted Soils Testing)

Engineering Consultancy & Research and Development
ESS offer bespoke engineering and design solutions. The team consists of specialist subsea expertise coupled with procurement, fabrication, and installation knowledge and experience. ESS are continually investing into research and development focusing on improving existing methodologies.

Ambient Lifting
ESS’s patented subsea lifting and positioning technologies
Ambient lifting is a flexible mechanism using incompressible gas which facilitates control of the ascent, descent and underwater positioning of offshore structures

Personnel
ESS provide a specialist personnel and resourcing support business service across the full spectrum of offshore requirements. Today more than £350 million of subsea projects are managed by ESS personnel resource for and on behalf of our clients.

Equipment Hire
A wide range of equipment is available for hire to support and deliver subsea installation projects including 800-2000Te Carousel, 10Te Hydraulic Tensioners, SCAR Plough in its four configurations and PREP (Plastic Reeled Elastic Pipelay System).
**SCAR Seabed System**

One system – 3 processes - takes trenching / back fill off the critical path

- **Route Preparation**: Clears many boulders quickly and effectively
- **Pre-cut trenching**: Trencher makes multiple passes within the existing trench
- **Backfill**: No part of trencher near the cable provides low risk solution for the cable

Robust through vast range of soils; reliable; fast trench production; versatile – Shore ends, shallow water, deep water
SCAR Seabed System – Route Preparation/Boulder Clearance

Specifications

- Clears swathe widths of 10 or 15m
- Can perform multiple passes to increase cleared width
- 20-50Te bollard pull required, seabed type/boulder frequency dependant
- Depth of seabed penetration controlled by altering keel depth
- Responsive, self-correcting steering arrangement allows for horizontal positioning accuracy of ±0.5m. Turns of radii of 50m possible
- Mass of 45Te, 14m (16m) long, 10m (15m) wide, 3m (3m) tall.
- Mobilised from yard on 5 (6) standard trailers; mobilised onto vessel within 24h
SCAR: Pre-cut Trench Mode

SCAR Seabed System – Trenching

Specifications

- 1st pass trench depth of 0.6-1.4m achievable, seabed type dependant
- Further 0.6-1.2m per pass achievable in 2nd or subsequent passes
- Unique in-trench multi-pass ability
- Trench side slope 35°
- Bollard pull of 35-100Te required
- Mass of 20Te, 7m length, variable mould board with and height
- Ballasted up to 38Te for harder soils
- Cutting tip variable for seabed type
- Single moving part, no electronics or hydraulics. Adjustable trench profile.
- Mobilised from yard on 4 standard trailers; mobilised onto vessel within 24h
SCAR: Post-Lay/Simultaneous Lay & Burial

SCAR Seabed System – Post-Lay and Simultaneous Lay and Burial

Specifications:

• Same trench depth specifications as Pre-cut trenching mode
• Multi-pass capable
• Suitable for rigid pipelines and flexible products
• Mass of 20-30Te, 10m length, variable mould board with and height
• Can be counter-ballasted to manage heavier products
• Suitable for shallow water and deep water lay
• Bespoke roller cradle design to handle wide range of product weights and diameters
SCAR Seabed System – Backfill

Specifications

• Catchment widths of 10 or 15m
• Unique split skid: no bearing surface of plough is in contact with open or recently filled trench
• 20-70Te bollard pull required spoil volume and type dependant
• Low seabed penetration <100mm
• Responsive, self-correcting steering arrangement allows for horizontal positioning accuracy of ±0.5m. Turns of radius 50m possible
• Mass of 45Te, 14m (16m) long, 10m (15m) wide, 3m (3m) tall.
• Mobilised from yard on 5 (6) standard trailers; mobilised onto vessel within 24h
• NO RISK TO PRODUCT
SCAR Seabed System

SCAR® SEABED SYSTEM

SCAR 1
- Pre-cut trenching (multiple-pass)
- Route preparation/boulder clearance

SCAR 2 / SCAR 3
- Pre-cut trenching (multiple-pass)
- Route preparation/boulder clearance
- Backfill

SCARJet
- Post-lay/simultaneous trenching
- Trench remedial works

SCARMax
- Pre-cut trenching (multiple-pass)
- Route preparation/boulder clearance
- Backfill
Reduced Risk

- Pre cut trenching & effective route preparation reduces risk of damage to the product
- Pre-cut trenching reduces the risk of not achieving specification in the given soils
- Decoupling the project schedule enables key elements to be removed from the project critical path
- Innovative technologies designed for smaller, cheaper and more readily available support vessels, significantly impacting on installation costs
- Full and continuous site investigation eliminates geotechnical uncertainties and enables optimal product route selection
Reduced Cost

- Removes inflated costs associated with a multi-tiered supply chain
- Shorter supply chain
- Pre agreed prices and standardised approach leads to more effective project planning and management, and enhanced cost control
- Fixed vessel rates with greener emissions provides additional fuel savings
- Innovative technologies that use smaller more cost effective vessels
- Safe, simple and robust tools resulting in improved trencher performance, minimal breakdown and reduced weather downtime
Increased Flexibility

• Reactive and proactive response to Client's needs
• Proven track record of demonstrating flexibility
• Tailored spread to suit specific projects (with or without vessel, services provided collectively or individually)
• ESS are continually developing innovation
• Speed of deployment from any global port (rapid and cost effective mobilisation and demobilisation)
• Scalability – no project too small or too big within our scope of services
• ESS equipment can be manufactured globally ensuring local content utilisation thus overcoming federal legislation such as the Merchant Marine Act of 1920 (Jones Act)
<table>
<thead>
<tr>
<th>Client</th>
<th>Project</th>
<th>Brief Description</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>Prysmian Group</td>
<td>Wikinger OWF</td>
<td>Pre-cut Trenching in single and multi-pass modes for 70 inter-array cable routes</td>
<td>2016</td>
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<td>(See Data Examples)</td>
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<tr>
<td>Prysmian Group</td>
<td>Wikinger OWF</td>
<td>Route Preparation/Boulder Clearance operations on 45 inter array routes</td>
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<td>(See Data Examples)</td>
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<tr>
<td>ABB Backfill</td>
<td>Caithness Moray HVDC Link</td>
<td>Pre-Cut Trenching, Cable lay and Backfilling 2 x 500m Trial Locations</td>
<td>2016</td>
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<td>Demonstration Project</td>
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<tr>
<td>Dong Energy</td>
<td>Race Bank OWF</td>
<td>Route Preparation/Boulder Clearance 2 x export cable routes</td>
<td>2015</td>
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<td>(See Data Examples)</td>
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<td>DONG Energy</td>
<td>Race Bank OWF</td>
<td>Boulder Grabbing utilising orange-peel grab</td>
<td>2015/16</td>
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<tr>
<td>Dong Energy</td>
<td>Westermost Rough</td>
<td>Multi-pass Route Preparation/Boulder Clearance operations on 37 inter-array routes</td>
<td>2014</td>
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<td>E.ON C&amp;R</td>
<td>Humber Gateway OWF</td>
<td>Route Preparation/Boulder Clearance 2 x 7km export cables and 2 inter array cable routes.</td>
<td>2013</td>
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<td>Siem Offshore</td>
<td>Baltic 2 OWF</td>
<td>Pre-cut Trenching along 86 inter-array routes</td>
<td>2013</td>
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<td>Contractors/EnBW</td>
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<tr>
<td>E.ON C&amp;R</td>
<td>Humber Gateway OWF</td>
<td>Demonstration project of SCAR Subsea Trenching System in Humber Gateway wind farm site. Route Preparation/Boulder Clearance, single pass and multi-pass Trenching successfully demonstrated</td>
<td>2012</td>
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<td>TOTAL</td>
<td>Laggan Tormore Oil Field Development</td>
<td>Route Preparation/ Boulder Clearing trials and subsequent 67km work scope along export pipeline route</td>
<td>2012</td>
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Thank you for listening!
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