Lowering The Cost Of Marine Energy With Affordable Subsea Connection Solutions

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Siemens Energy
Who are we?

Siemens Energy

- 86,000 employees worldwide
- Wind, Hydro & Ocean, Oil & Gas, Fossil Power

Subsea Electrical & Fibre Optic Connection Systems for Marine Energy

Our approach to subsea connection systems

- What ‘Marine Renewables’ says is needed – “The Challenge”
- Justification for wet mate methodology
- Status today?
- Where we are going tomorrow?
Wet Mate Connectors

- What are wet mate connectors and how do they work?

- Basically, they are electrical Plugs and Sockets which can be repeatedly connected and disconnected whilst they are under the water

- But more about that later...
Visualising “The Challenge”
How are we going to connect all this together?

- Floating devices
- Fixed foundations
- Removable Nacelles
- Multi-device platform
- Hubs
- Export cable
Defining “The Challenge”

How to connect / disconnect (deploy / recover)
farms of devices ...
to the subsea cables ...
...but in tidal / wave environment ...
...and that will last for life of the farm...
...and in an affordable manner (Through Life Costs)

Industry messages
- Supply chain investment required.
- Single contract – integrated solution.
Subsea Connection Solutions
Why Wet Mate connector technology?

- Estimated 35-45% lifetime costs attributed to Installation and O&M (1)
- Reduced LCOE (‘affordability’) through reduced installation and O&M costs:

- Credible cost effective alternative to Dry Mate or hardwired connectivity
- Potential benefits
  - Speed of deployment / recovery – staged installation, devices/interconnections
  - Predictability of operations – repeatable – no over-runs
  - Improved H&S – minimise activities at sea on the surface
  - Lesser dependence on weather window
  - Power cable management – minimise disturbance/excess length/damage risk

Wet Mate Connectors today

Wet mate connectors exist!
- Thousands of connectors deployed.
- 11kV connectors first deployed 25 years ago.

Existing Range
- 690V through to 11kV
- Low Voltage auxiliary power
- Copper Ethernet
- Fibre Optic connectors

Ultra-high reliability heritage
- Unparalleled MTBF figures
- Deployment duty for whole life of farm
- No maintenance required
Meeting “The Challenge”

Reliable, Wet-mate, Hybrid, Integrated Connection Management System (CMS)

- **Ultra-reliable** = 25 years, zero maintenance, zero failure expectation
- **Wet mate** = Under-water ‘Plug and Socket’
- **‘Hybrid’** = contains MV, LV, FO all in one ‘plug-in’ operation
- **‘Integrated’** = from subsea cable end to device internal cable

Example of Connection Management System termination ‘nodes’
Connection Management System

8kV 4MW
Length = 1500mm
Height = 1000mm
Width = 1000mm
Connection Management System - Deployment

Deployment Sequence

1. Bend Restractor
2. Bend Stiffener
3. Installation
4. Connecting to Crane
5. Securing CTH on Turbine
6. Removing CTH from Parking Frame
What’s next for connection systems?

Incorporating new products focused on cost and specification for high-volume / low cost manufacture

<table>
<thead>
<tr>
<th>Connection System cost (£)</th>
<th>Demo projects</th>
<th>Farm Developments</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.£750k</td>
<td>Existing products</td>
<td>Project-specific engineering, high NRE</td>
</tr>
<tr>
<td>80%</td>
<td>Introduction of new products, low-cost high volume</td>
<td></td>
</tr>
<tr>
<td>c.£150k</td>
<td>High economies of scale</td>
<td></td>
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</tbody>
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New product development, standardisation

High / zero NRE

Standardisation

Today

1 10 30 60 QTY

2025 YEAR
Summary

- The scale of future arrays will require a subsea connection infrastructure that will maximise the availability of wave and tidal devices
- Wet mate connector methodology is a prerequisite to affordable array/farm deployments
- Wet mate technology exists, is proven and is reliable
- With volume comes significant cost reduction
- The proposed subsea connection system solution addresses some of the gaps and barriers to the development of a wave and tidal industry
Thank you for your attention