Developing silent screw anchors for offshore floating wind, wave and tidal energy devices

B. Cerfontaine, M. Brown, J. Knappett

**Offshore Renewable Energy**

**What are the offshore sources of energy?**

- **Wind**
- **Tidal stream**
- **Waves**

**Which foundations and anchors are used?**

- **Bottom-fixed**
- **Floating**

<table>
<thead>
<tr>
<th>Source</th>
<th>Capacity</th>
<th>Jobs by 2030</th>
<th>Exports by 2030</th>
<th>Potential for UK's electricity needs by wave and tidal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore wind</td>
<td>11GW</td>
<td>27,000</td>
<td>£2.6bn/y</td>
<td>20%</td>
</tr>
<tr>
<td>Equivalent home power by offshore wind (UK)</td>
<td>8 million</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Challenges & Objectives**

**What are the challenges for offshore foundations and anchors?**

1. **Avoid pile driving (hammering) installation: nuisance for sea mammals; need for silent installation**
2. Feasible in deeper water depths (≥ 30m): Most locations in development in the North Sea are beyond that limit
3. Cost-efficient: foundation is up to 1/3 of total cost (too much for wave and tidal)

⇒ Large dimension screw piles meet these challenges, but can we install, design and build them?

**Research methodology and results**

**Can we install screw piles in offshore conditions?**

**What is the screw pile pull-out capacity?**

- **Capacity = anchor failure**

**What pull-out capacity can be mobilised?**

- The pull-out capacity is equivalent to the weight of 4 blue whales hanging on the pile.

**Conclusions**

We have shown that the screw pile technology

- **Is installed in an environmentally friendly way**
- **Can be installed in offshore conditions**
- Provide pull-out capacity sufficient for the needs of offshore wind, wave and tidal energy (but also for aquaculture development)

**Impact**

Our work will foster the British offshore industry and enables it to take the lead in the development of new floating markets (USA, Taiwan...). We have started to work with offshore stakeholders to implement our findings in the practice.