



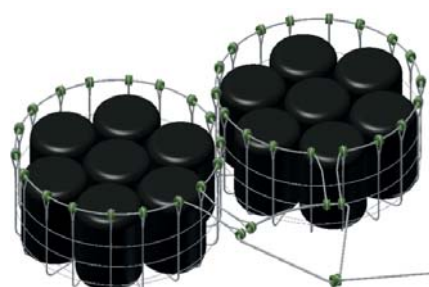
**TTI is the worlds leading authority on mooring systems for the marine renewable market including wave, tidal and offshore floating wind. Our engineers have significant experience and can cover all aspects of mooring from initial concept to detail design, fabrication support and project delivery.**

With focus towards synthetic mooring systems our designs have been proven to offer significant improvements in anchor and structural loads. These can be considerably lower than conventional steel moorings and with improved mooring footprints and array densities can dramatically improve the MW/km<sup>2</sup>.

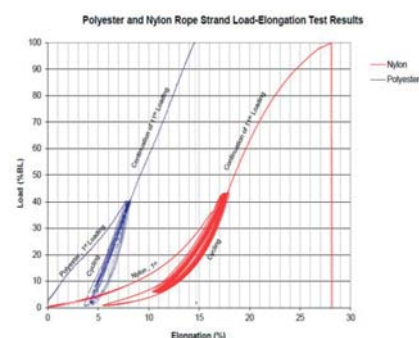
Working closely with key collaborators, and supported by Carbon Trust and The Scottish Government, TTI has been working extensively on testing, qualification and the commercialisation of a nylon synthetic

mooring system. Key activities of the development project have been;

- Rope qualification for use in permanent moorings [up to 1000t]
- The development, construction, testing and staged qualification of synthetic bag anchor system that offers a cost effective solution suitable for a wide range of seabed types



- Development of a recommended practice for stiffness modeling of non-linear nylon for mooring designers.



- Laboratory testing of nylon ropes including a 20 million cycle fatigue test.
- Field testing deployment and recovery of anchor bags.
- Cost benefit and feasibility studies.

Other services TTI can offer include;

**Original Research & Development**

- Innovation
- New software
- Whole system FEED studies

### Testing

- Test program design
- Design and operation of bespoke test rigs and test regimes
- Interpretation of Results
- Management of wave tank testing for mooring development and survivability
- Numerical modeling comparisons with tank testing and validation
- Specification of sensors and measurement systems for field and tank testing of moorings.

### Component Design & Manufacture

- Selection of mooring ropes
- Associated hardware
- Manufacturing methods
- Finite Element Analysis (FEA)
- Quality control
- Quality assurance

### System Design

- System design and optimization using Orcaflex.
- System Response (e.g. energy absorption, load excursion etc)
- Lifetime Prediction
- Relevant Regulations & Guidelines
- Detail design and specification of mooring systems.

### System Installation & Monitoring

- Method and manuals including marine operations, HAZID's, etc.
- Supervision
- Retirement Criteria

### Project Management

- Specifications for Purchasing
- Supplier Review
- Procurement

- Documentation
- Overall Management & Budget Control
- Installation and commissioning

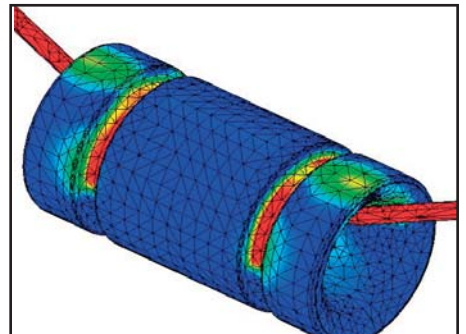
### TTI ACHIEVEMENTS

#### Software

- Fibre Rope Modeler - Rope Design and Analysis
- OPTIMOOR – Vessel Mooring Analysis
- NET – Riser Protection Net
- OPTI-LIFE - Hawser Life Prediction

#### JIP's / R & D

- Demowind project WIP10+ in association with other European partners for the development and commercialisation of floating wind technology. Funded by DECC
- MRCF Testing, Qualification and Commercialisation of Advanced Mooring Systems for Wave and Tidal Arrays
- Carbon Trust Moorings and Anchors for Wave Energy Devices
- InnovateUK (formerly TSB) - Development of synthetic fibre polymer lined fairleads
- DTOcean - FP7 Optimal Design Tools for Ocean Energy Arrays
- Scottish Enterprise inter-array cabling project for tidal arrays
- Development of mooring system for Laminaria wave energy converter for testing at EMEC. Funding by InnovateUK under the OCEANERA-NET programme with other European partners.



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