

COMPARATIVE COST-BENEFIT ANALYSIS OF LOAD REDUCTION POLYMER COMPONENTS ON A EUROPEAN FOWT PROJECT.



Eve Johnston

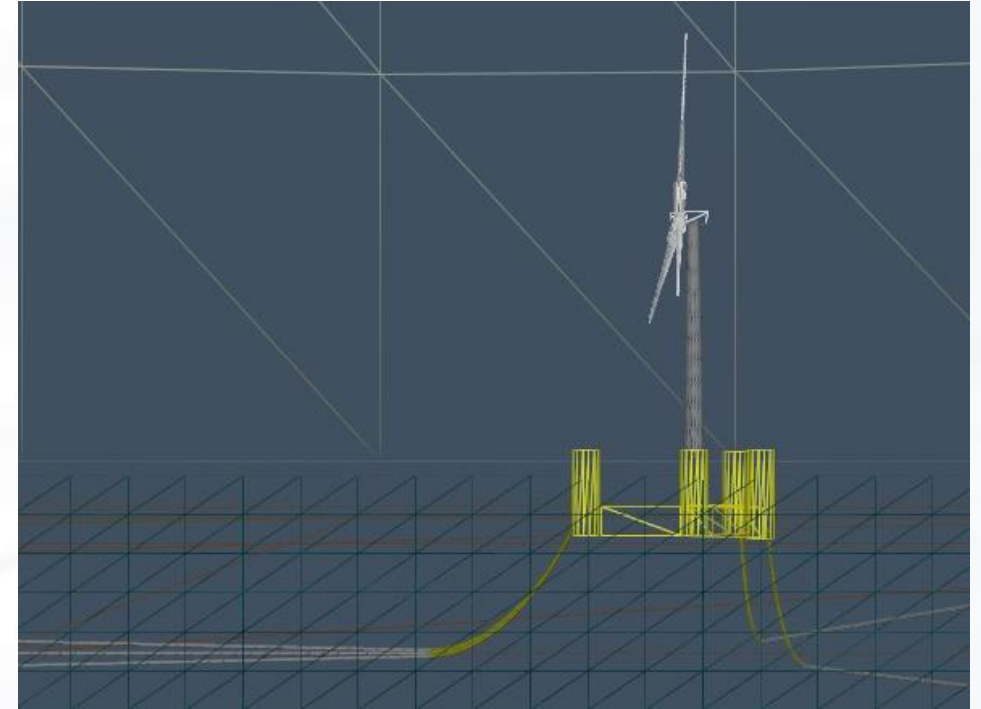


The Case:

- Pre-commercial small farm
- Semi-submersible 6MW platform – catenary chain spread mooring system.
- Enigmatic environment in shallower water conditions, the ULS:
 - >30m/s wind speed
 - >10m significant wave height

The Challenge:

- High peak tension in ULS cases (design driver)
- Cost increase for small frequency conditions.

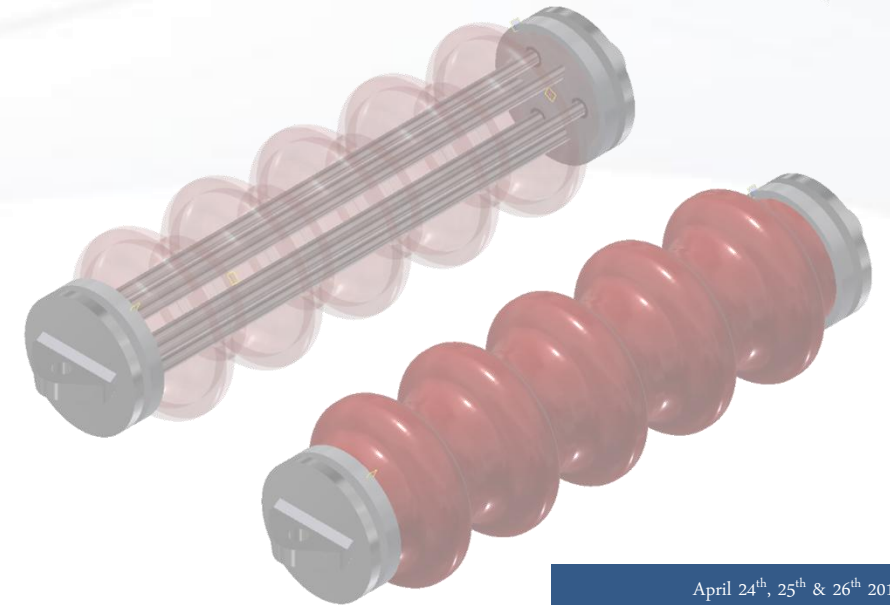
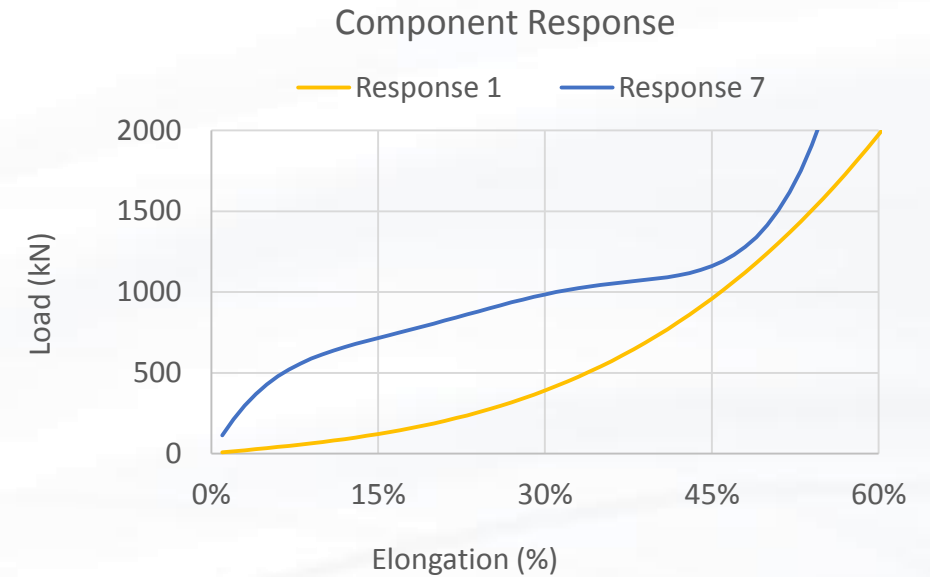


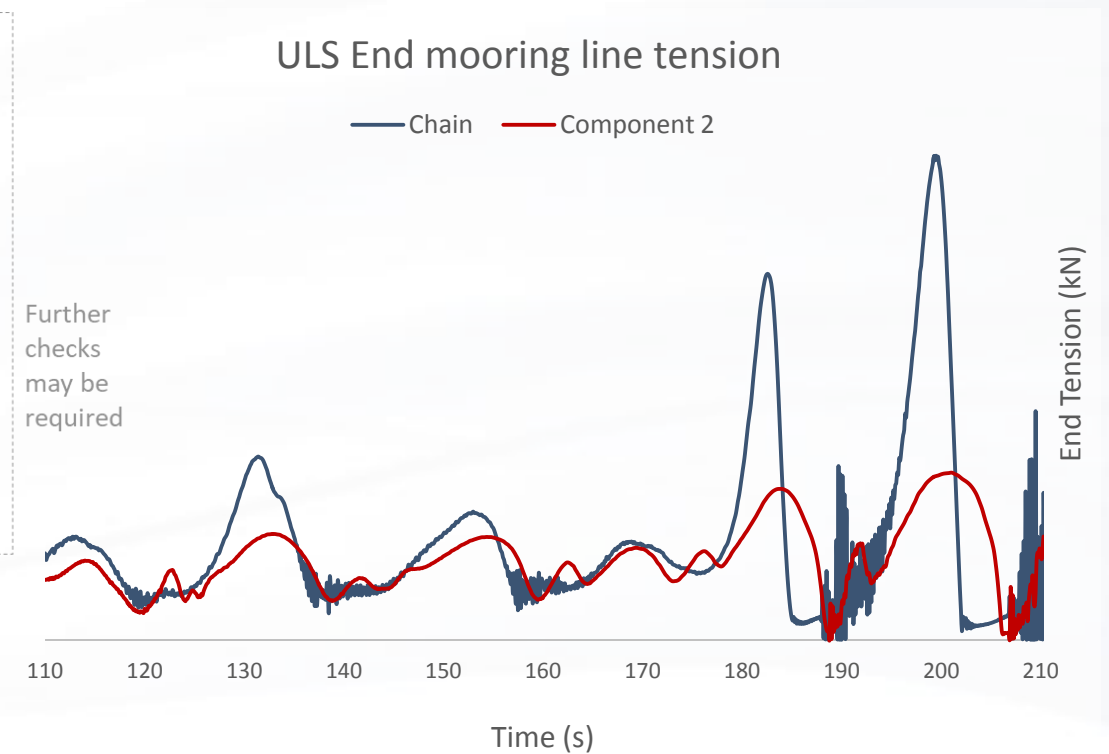
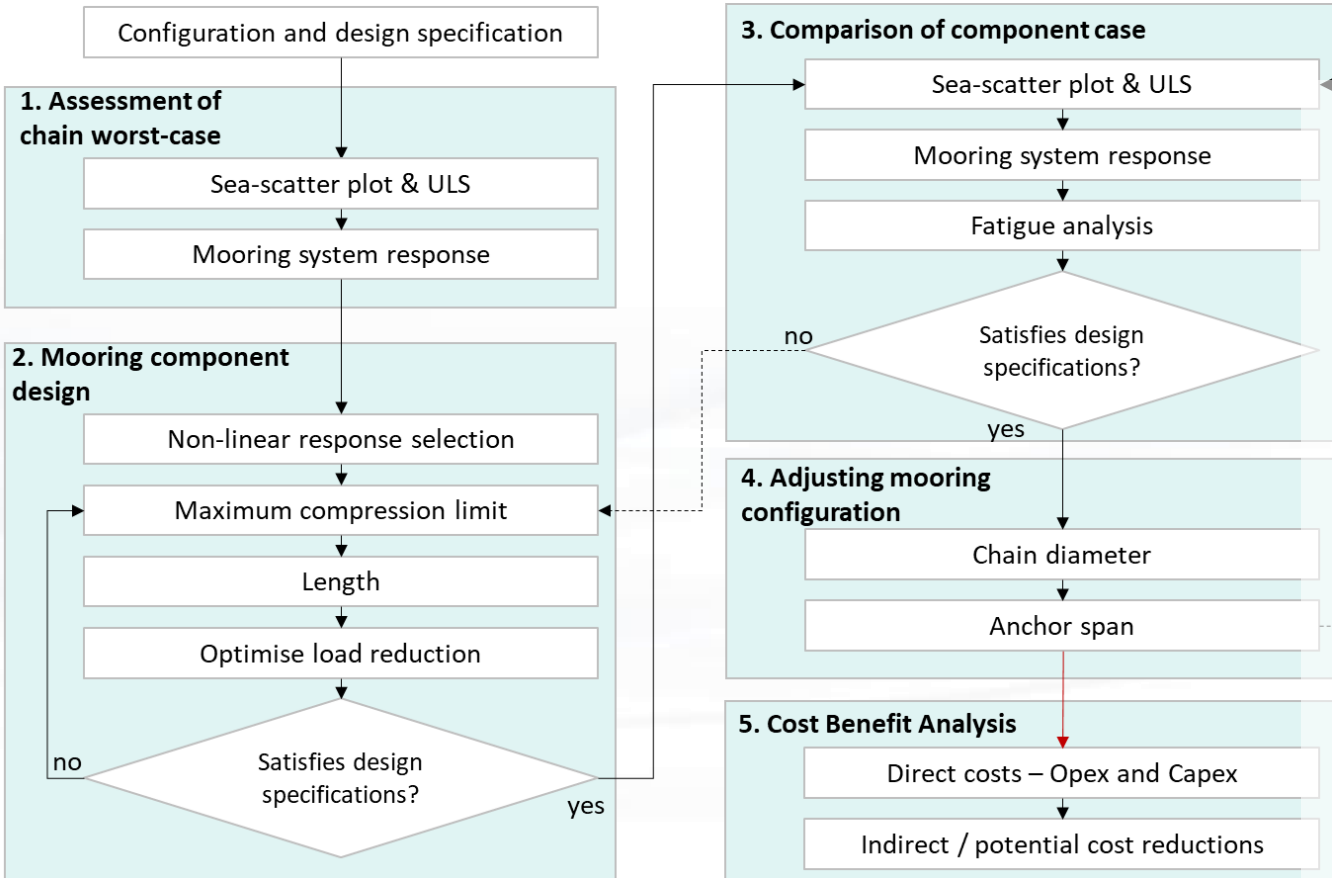
Purpose of TFI Polymer Mooring component:

- Reduces compliance
- Reduce peak loads
- Minimise cyclic loading

How:

- Thermoplastic polymer compression shells
 - Material designed for cyclic loading
 - Specifically designed non-linear stress-strain response
- Elongation of framework.





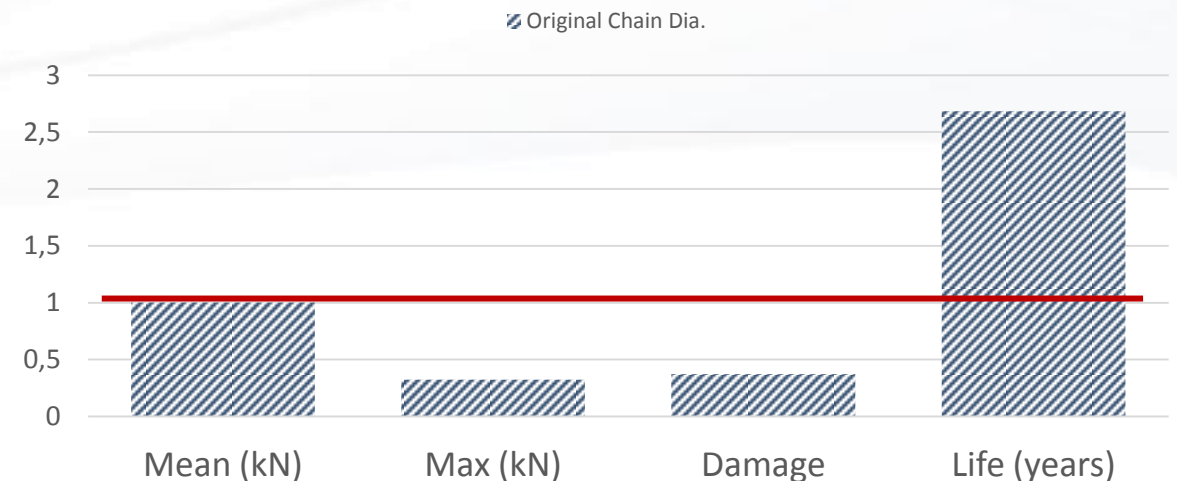
Chain case VS Component case

- Load reduction:
 - Greatest in extreme sea states.
 - Benefits across most sea states.
 - Minimisation of peak loads.
- Fatigue analysis:
 - Cyclic load reduction
 - Frequency high load minimised.
 - Damage reduction.
 - Increase in fatigue life.

Percentage benefit on end loads

Hs/Tp	5.2	7.8	9.1	11.7	13	15.6	18.2
2	5.6%	1.6%	4.1%	2.6%	2.0%	7.5%	8.7%
4	3.1%	-1.8%	3.1%	2.2%	-5.5%	8.0%	9.7%
6		-4.3%	2.0%	2.9%	20.0%	30.5%	40.0%
8			12.0%	37.5%	54.8%	61.7%	57.9%
10					71.5%	72.1%	67.5%

Comparitive Component Benefit

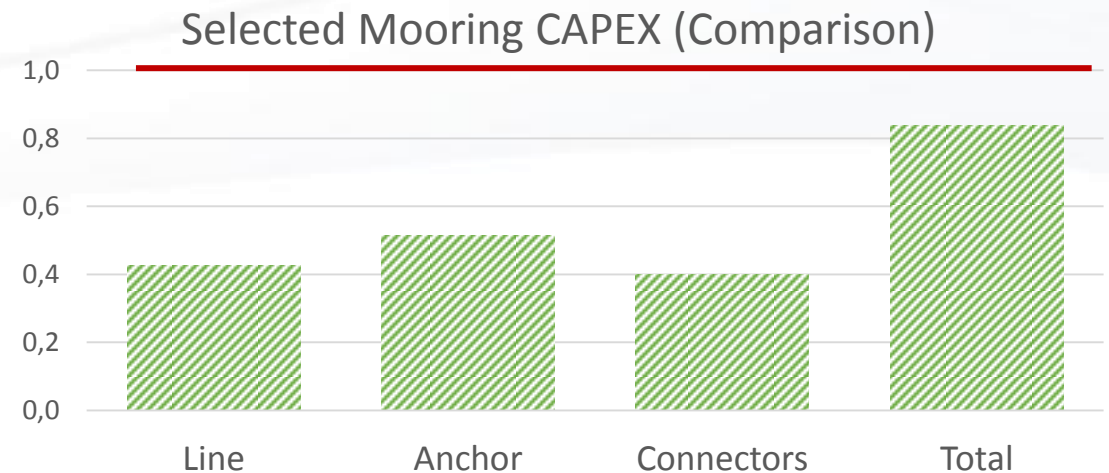
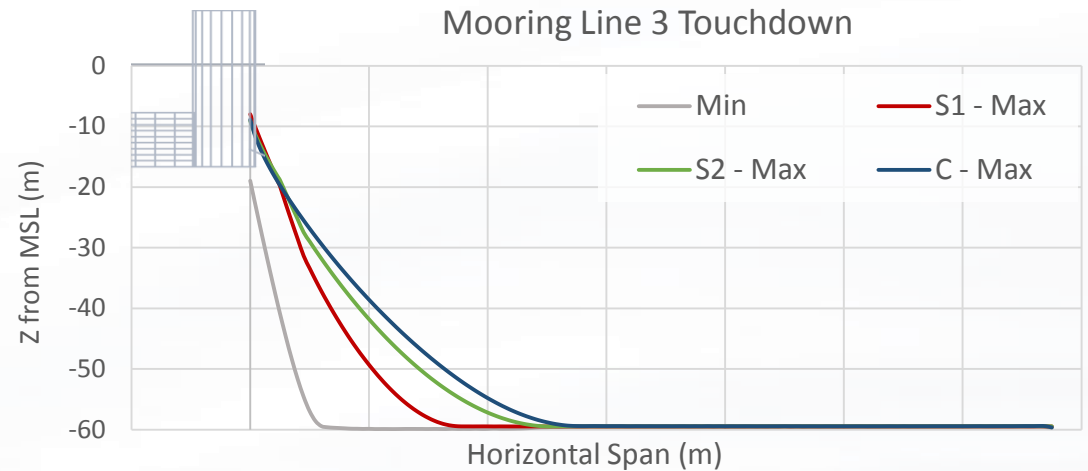


Direct Impact:

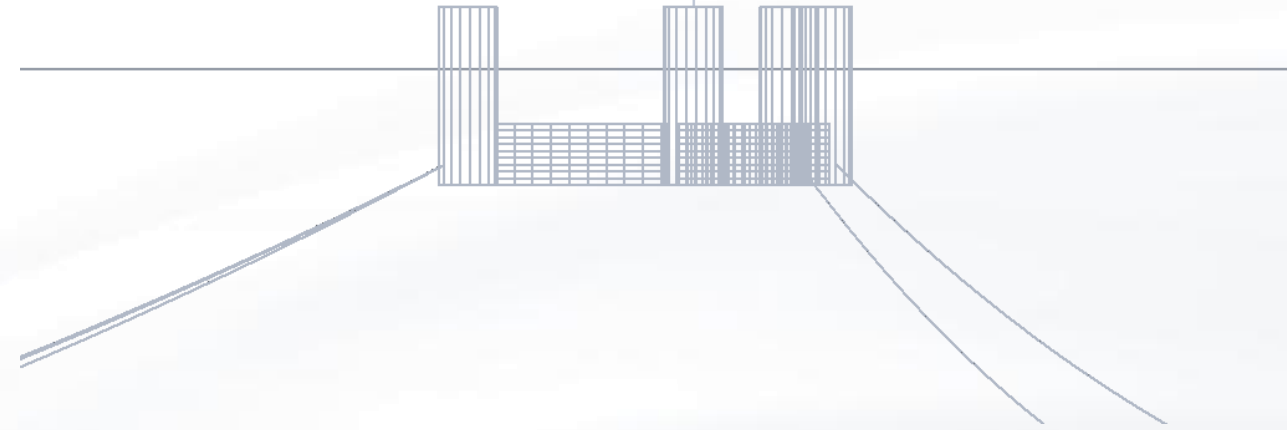
- **Cost of Mooring Line:**
 - Chain and anchor,
 - Connectors and tensioners
- **Cost of Platform**
 - Connections, reinforcements
 - Sizing

Secondary Impact:

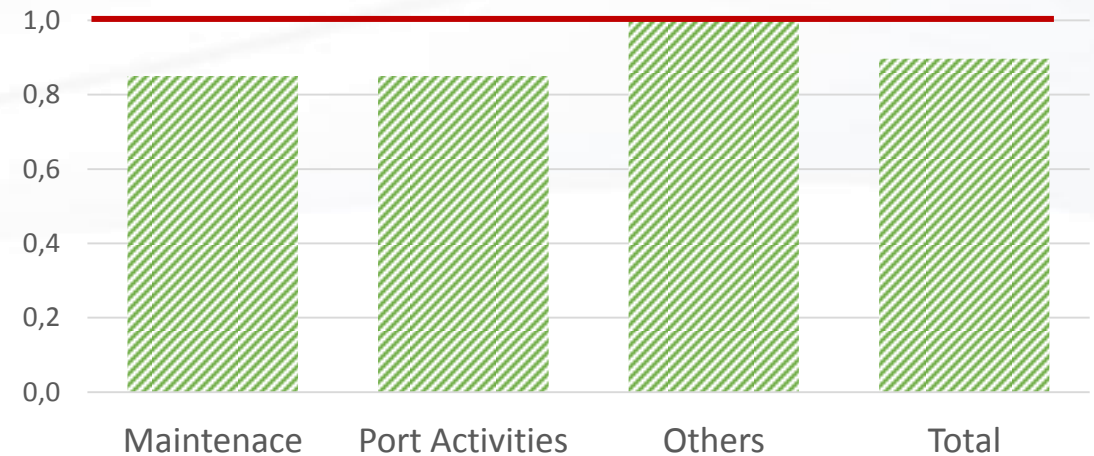
- **Cost of Mooring Installation**
 - Decrease in bollard pull
 - Decrease in vessel handling requirements
- **Cost of Platform Installation**
- **Reduced Installation Risk**



- Reduced Maintenance
 - Mooring: chain and anchor fatigue
 - Platform: peak loads and fatigue
 - Turbine: sudden impact damage
- Reduced Operations
 - Operational downtime
 - Vessel size and time
 - Port activities minimised
- Increased Capacity Factor
 - Due to decreased downtime
 - Higher background load handling capability

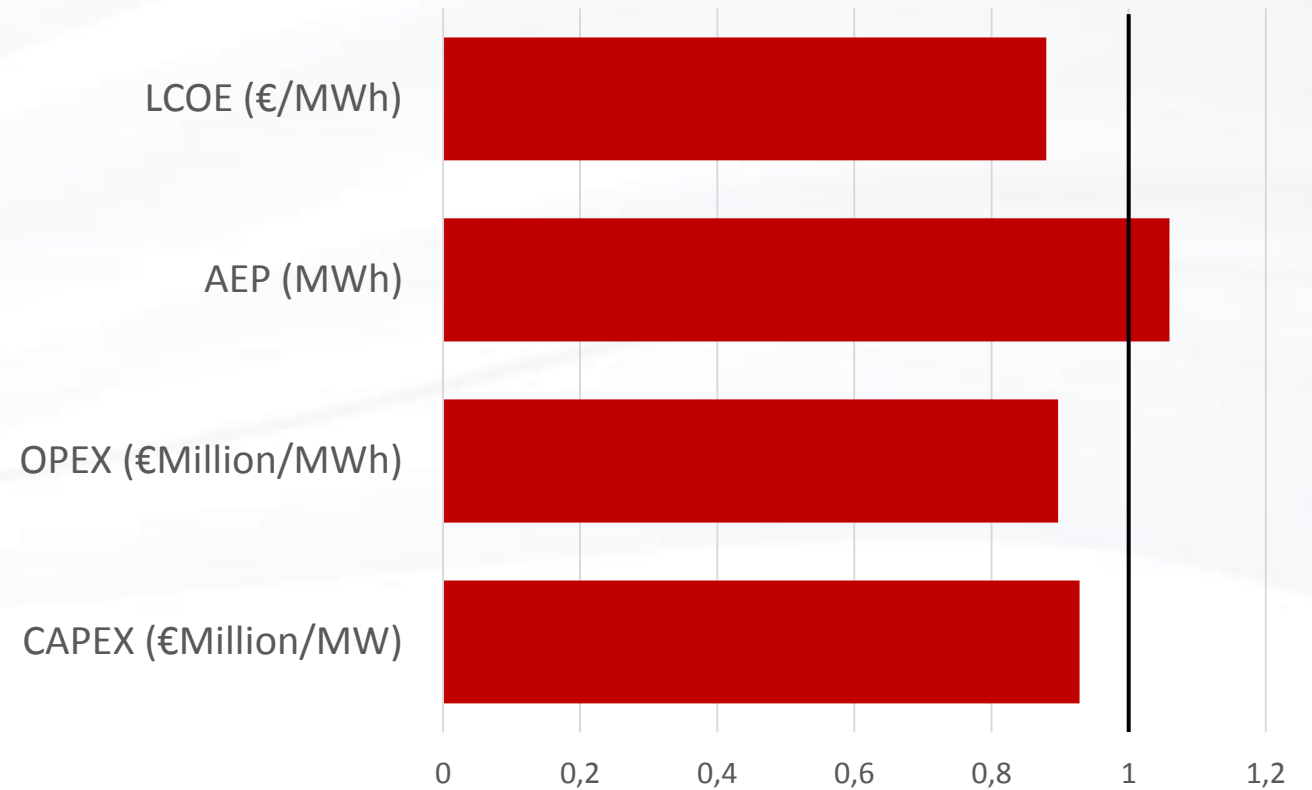


Selected OPEX (Comparison)



European Floating
Offshore Wind Farm
+
Polymer Mooring Component
(First FOWT Deployment)
↓
Peak Load and Fatigue Reduction
=
>12% saving in LCOE

Comparative Cost Benefit



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Questions ?
Or want to get in contact:

EVE JOHNSTON



Eve.johnston@tfimarine.com

PAUL MCEVOY



Paul.mcevoy@tfimarine.com



www.tfimarine.com

