

Bombora-ESP offers a comprehensive range of services for the installation of offshore facilities. Our considerable knowledge, experience and expertise in this field enables us to:

- provide operators with confidence in the installability of their proposed concepts;
- assist installation contractors develop optimal solutions within vessel operability limits; and
- validate solutions proposed by prospective installation contractors.

Using in-house and 3<sup>rd</sup> party proprietary software, Bombora-ESP can provide analysis services for the installation of the following assets:

- Rigid pipelines and flowlines.
- Subsea hardware.
- Floating and fixed facilities.
- Spools, risers, umbilicals, power cables and mooring systems.

### Rigid Pipelines and Flowlines

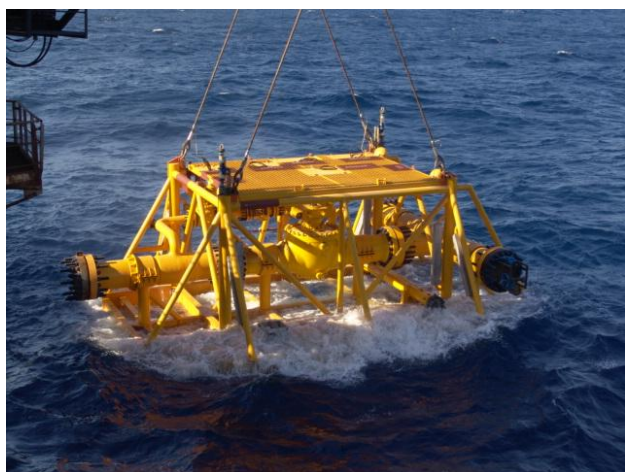


Bombora-ESP supports its clients by offering the following services in relation to the installation of rigid pipeline systems:

- Pipelay analysis (S-lay, J-lay or reeling).
- Pipelay initiation and laydown sequence, set-down loads and bending limits.
- Abandonment and recovery analysis.
- Towing analysis (bottom, mid and surface).
- Beach pull-in analysis.
- Barge/ vessel suitability.
- Barge/ vessel stability.
- Sea state limits and operability criterion.
- Fatigue analysis.

- Dynamic analysis of mooring systems.
- Anchor tension requirements.
- In-line structures.
- PLET installation.
- Pipeline/ cable crossings.
- Alternative configurations: bundles, piggy-back, pipe in pipe, etc
- Development/review of installation procedures.
- Real time installation support.

### Subsea Hardware



Significant costs may be saved by installing subsea hardware in an optimal manner (in terms of vessel selection and optimisation of installation schedule). Bombora-ESP supports its clients by offering the following services in relation to the installation of subsea hardware:

- Loadout and transportation analysis.
- Deck loading (grillage) and sea fastening analysis.
- Lifting analysis.
- Over boarding limits.
- Vessel to vessel lifting.
- Splash zone loading and slack line investigations.
- Resonance and dynamic motion investigations.
- Touchdown and near bottom hydrodynamic effects.
- Cross hauling and pull-in loadings.
- Design of installation aids.
- Rigging design.
- On bottom stability analyses.

- Tie in loadings for PLEMs, PLETs, manifolds etc. and loads on guide tubes
- Novel installation techniques
- Development/review of installation procedures.
- Real time installation support.
- Remedial actions in the case of mishaps

### Floating and Fixed Facilities



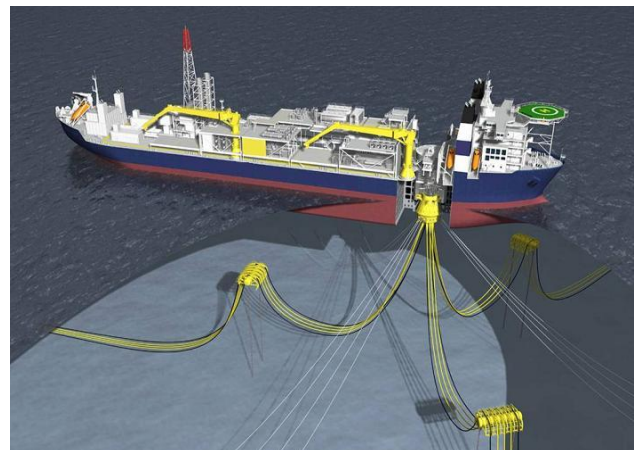
Bombora-ESP supports its clients by offering the following services in relation to the installation of floating and fixed facilities:

- Loadout and transportation analysis.
- Launch analysis.
- Floatation and up-ending analysis.
- Lifting analysis.
- Permanent and disconnectable mooring systems.
- Hull form analysis (hydrodynamic and hydrostatic) and selection.
- Coupled body response assessment.
- Anchor/ pile selection.
- Mooring system installation analysis.
- Mooring system load monitoring, fatigue and integrity assessment.
- Metocean conditions review.
- Uptime analysis.
- Vessel motion analysis.
- Trim, stability and ballasting calculation.
- FPSO hold-off assessment
- Development/ review of installation procedures.
- Real time installation support.

### Spools, Risers, Umbilicals, Power Cables and Mooring Systems

Bombora-ESP supports its clients by offering the following services in relation to installation of spools, risers, umbilicals, power cables and mooring systems:

- Loadout and transportation analysis.
- Deck loading (grillage) and sea fastening analysis.
- Lifting analysis.
- Splash zone loading and slack line investigations.
- Design of installation aids.
- Rigging design.
- Flexible riser installation analysis.
- Umbilical/power cable installation analysis.
- J-tube pull-in analysis.
- Pull-in clashing studies.
- Development/ review of installation procedures.
- Real time installation support.



Please contact us to discuss your needs and requirements in more detail.