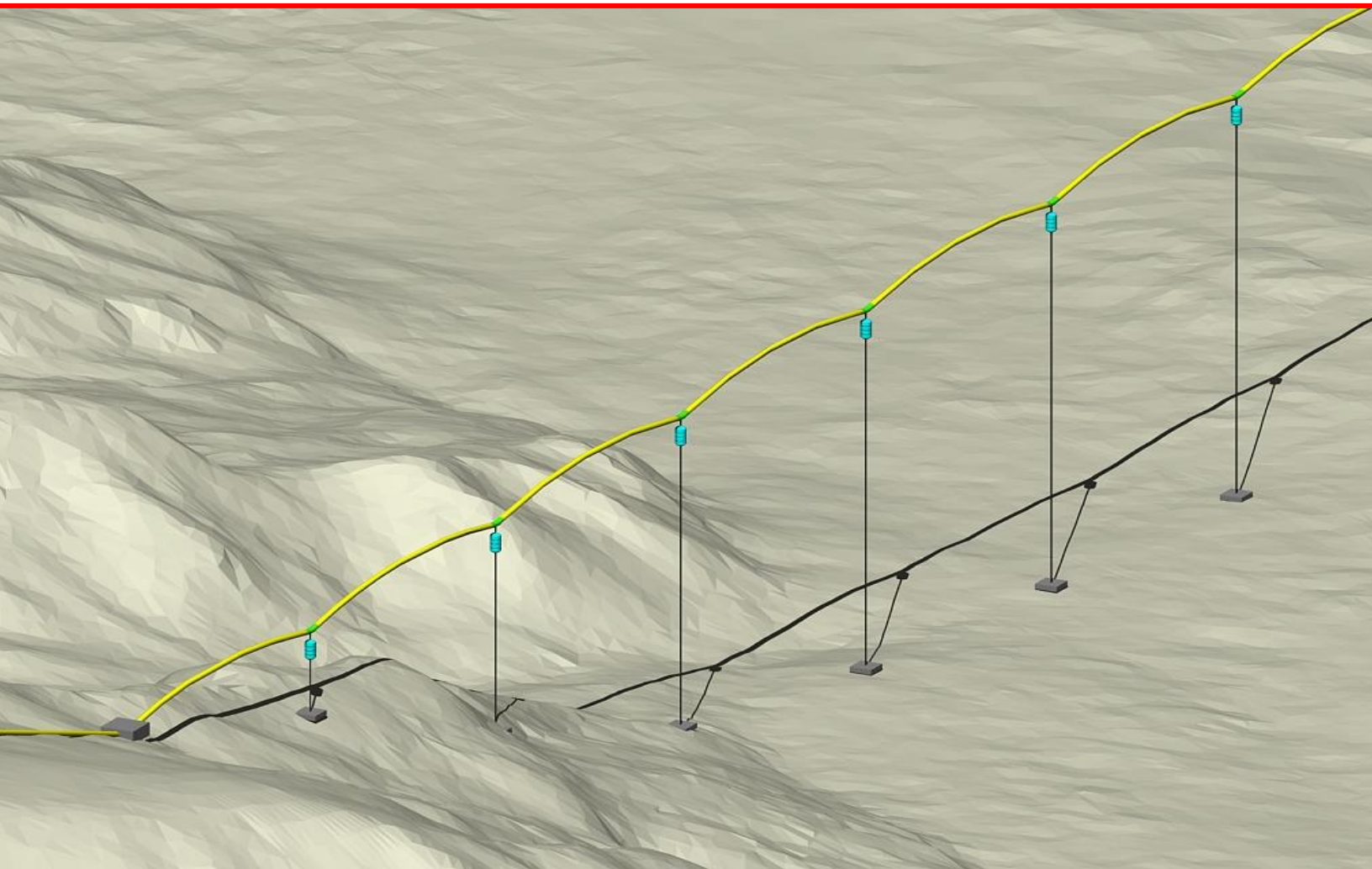
INTECSEA
WorleyParsons Group

Offshore Water Pipelines and Wind Turbines

Capability and Experience



Capability Overview

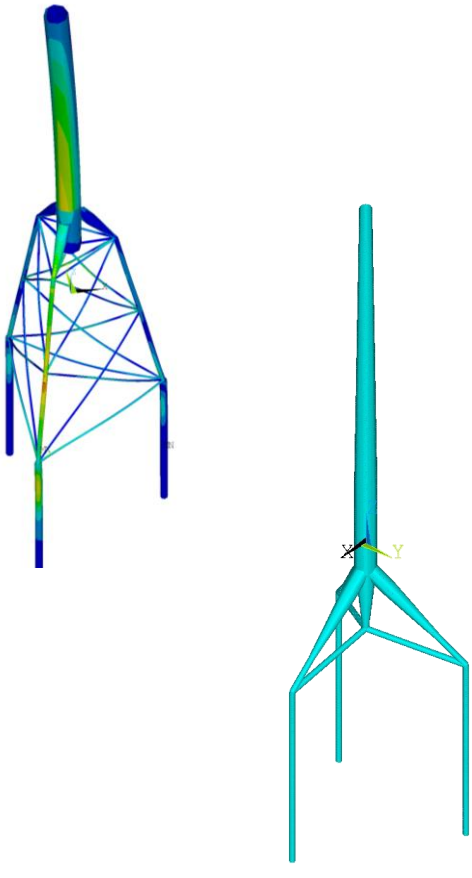
Wind Turbines

With recent developments in offshore wind energy, INTECSEA has been asked to contribute its specialized offshore knowledge to various offshore wind projects; mainly in the area of foundation design and structural analysis. Due to its extensive experience in design of systems for marine environments, INTECSEA is well-positioned to contribute to the growing offshore wind industry.

INTECSEA has been increasingly involved in the offshore wind industry through its offices in Delft, the Netherlands, and Houston, Texas. INTECSEA supported the NoordzeeWind consortium during the development of the Offshore Windpark Egmond aan Zee in 2006. Also, in 2007, INTECSEA supported Shell Wind Energy with technical definition studies for two prospective wind parks off the Dutch coast. Most recently, INTECSEA has performed a study of tripod foundations for larger turbine units. This study was performed in cooperation with the Technical University of Delft and developed a jacket tripod design. Furthermore, INTECSEA has experience in performing root cause and fitness-for-service analyses for wind turbine support structures.

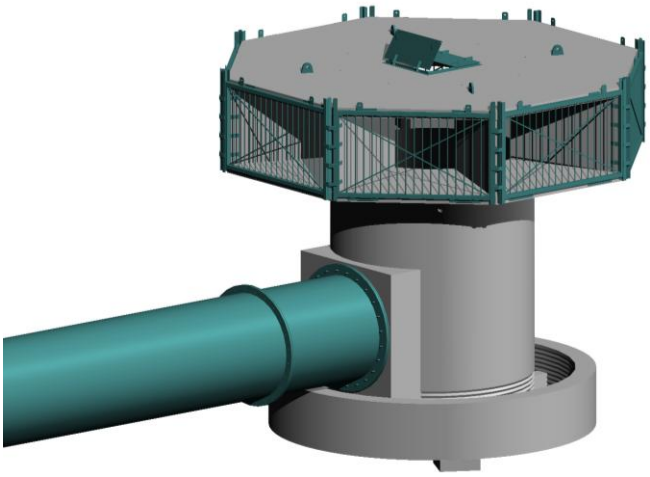
To support offshore wind turbines' foundations engineering and analysis, INTECSEA has acquired extensive experience with a wide range of specialized software and tools such as ANSYS (for structure definitions, modeling and simulations) combined with dedicated input/output scripts, SACS (for detailed structural design), ABAQUS and MathCAD calculation sheets.

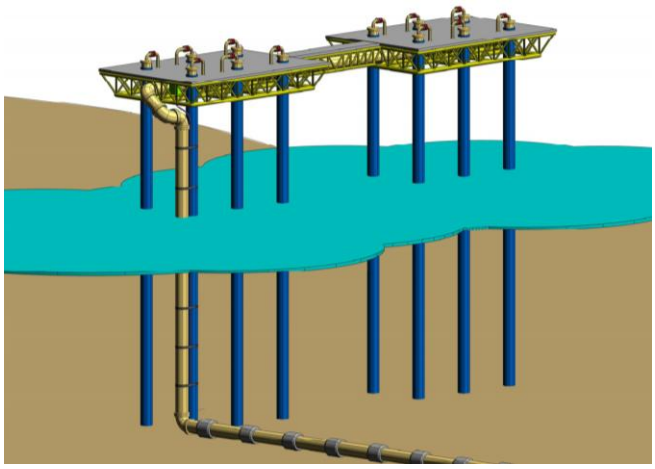
.

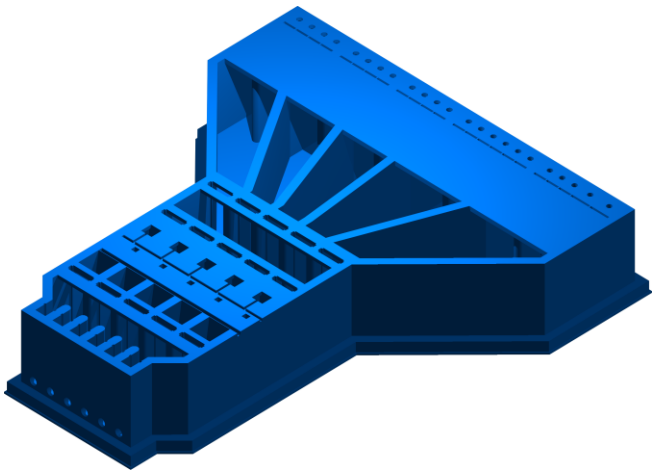


INTECSEA
WorleyParsons Group

Offshore Water Pipelines







INTECSEA's primary emphasis has been on pipeline applications in frontier areas, notably deepwater and Arctic environments. These specialized technologies are firmly established within INTECSEA's extensive project experience, including practical design and installation technology required for cost-effective completion and operation of marine pipeline facilities in all environments. For more than 10 years INTECSEA has successfully applied its offshore expertise on several offshore and nearshore water pipelines, intakes, offshore pump stations, and SPMs.

INTECSEA's experience includes a wide range of projects from industrial water pipelines, such as the basic and detailed designs of Sea Water Intake Phases 1 thru 6 for South Pars Field Development (including procurement and construction assistance), to the long distance transportation of fresh water.

To support detailed pipeline system engineering and analysis, INTECSEA has acquired extensive experience with a wide range of specialized software tools applied for steel, HDPE, MDPE, and GRP pipelines. These key programs run on a network of high specification PCs and are supported by INTECSEA's extensively verified in-house calculation and design procedures.

Thanks to its pipeline design excellence and recent experience in water pipeline and intake systems, INTECSEA benefits from an advantageous position in the market to perform water pipeline engineering.

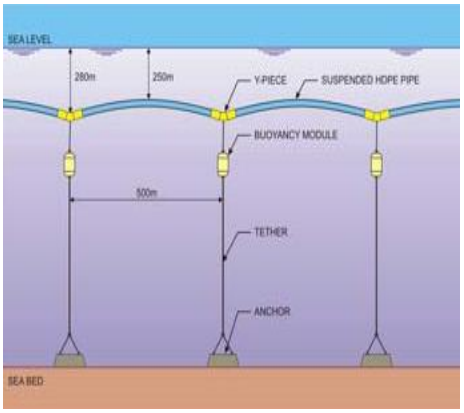
Project Experience

Project: **Cyprus Water Supply Project**
Client: **Alsim Alarko Contracting Company**
Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Mediterranean Sea

Feasibility assessment and detailed design of a suspended, floating water pipeline system

The Turkish General Directorate of State Hydraulic Works (DSI) had been evaluating the construction of a pipeline between the Turkish mainland and the northern coast of Cyprus to provide fresh water to the island. DSI awarded a contract for design and supply of such a system to Alsim Alarko Contracting Group in 1998. The pipeline diameter will be 1,600mm and the total length of the offshore section will be approximately 80km. The pipeline material will be High Density Polyethylene (HDPE) as commonly applied for water transportation systems. A main technical challenge for the Cyprus Water Supply Project is the offshore crossing, which must traverse water depths of up to 1,430m in a region prone to geohazards, seismic activity and a high level of submarine traffic. A suspended, floating pipe arrangement has been proposed for the offshore crossing. When built, this pipeline will be the first of its kind in the world.



Project: **South Pars Gas Field Development**
Client: **SAHEL Consultant Engineers on behalf of SEPANIER**
Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Persian Gulf

Design and engineering consultancy for seawater intake facilities, HDPE pipelines and onshore facilities work.

The South Pars gas field is located in the Persian Gulf (largest world gas field) and is being developed by the National Iranian Oil Company (NIOC). A Seawater Intake System will be constructed to provide water to phases 15 and 16 (and other future phases).

Five (plus one spare) HDPE pipelines (each 2,500m long) will supply 40,000m^3/h of seawater to onshore facilities including a desalination unit with a capacity of 12,000m^3 per day. The facility will be based on a gravity-filled pump basin.

Project: **Black Sea Water Line (Revze Pipeline)**
Client: **Kutay Insaat Taahut Ltd. Stii**
Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Black Sea, Turkey

Definition of pipeline and pumping requirements; preliminary hydraulic design

The City of Istanbul Water Authority (ISKI) is evaluating options for increasing the supply of fresh water. One of these options is the import of river water from a location at Rezve, near the Bulgarian border. The Rezve pipeline would supply 200,000,000m^3 of fresh water per year to Istanbul. Both large-diameter steel and HDPE pipelines are being considered.

INTECSEA has been contracted by KUTAY to further develop the offshore pipeline concept. At this stage, the focus is on the hydraulics of the water transportation system including options for offshore pumping stations. In addition, a preliminary on-bottom stability analysis of the pipeline was carried out in order to determine the required concrete thickness.

Project: **Long Island Offshore Wind Park (LIOWP)**
Client: **Florida Power and Light**
Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Atlantic Ocean
(10 miles south of Long Island)

Prepare the technical elements of the permit application

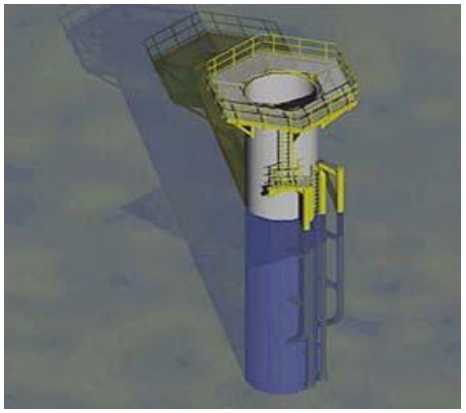
INTECSEA was contracted to provide general owner's engineer services, technical assessment, offshore engineering and offshore project management expertise, and advice for the overall development of the Long Island Offshore Wind Park. The primary focus of the work was to prepare the technical elements of the permit application, then submitted to the US Army Corps of Engineers, now under the authority of the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE).

Project: **Installation and Construction Feasibility Study**
Client: **National Renewable Energy Laboratory (NREL)**
Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

US Coastline

Installation and construction feasibility study

INTECSEA, along with BOEMRE, performed a review of wind turbine foundation concepts for installation and construction feasibility and risks. The study, to last two years, considered conventional monopile, gravity based, jacket, and hybrid structures. The study examined the economic feasibility of these foundation concepts for installation in varying water depths.

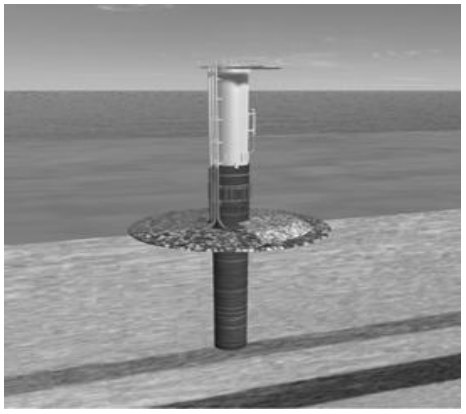


Project: **Offshore Wind Park Egmond-Aan-Zee (OWEZ)**
Client: **Noordzee Wind (Shell Wind Energy and NUON Renewables)**
Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

North Sea, Dutch Sector

Provision of expert consultancy services

The Offshore Windpark Egmont-aan-Zee is located in the North Sea off the coast of The Netherlands. It is installed in 18m-20m of water and consists of 36 turbines. The turbine generators used are the Vestas V90, which are capable of producing up to 3MW of power. INTECSEA provided technical support to the owner and operator of the park, Noordzee Wind.



About INTECSEA

(click here to learn more about INTECSEA)

For more than 25 years, INTECSEA has provided frontier technology leadership for the energy industry's most challenging offshore field development and pipeline projects.

INTECSEA was formed in 1984 and provides design for floating systems, risers, pipelines, and subsea engineering and construction management services within the global WorleyParsons Group. INTECSEA has established operating offices in Houston, Kuala Lumpur, Singapore, Delft, Rio de Janeiro, Jakarta, Angola, Cairo, St. John's, Perth, Melbourne, and London. (see all WorleyParsons' locations)

INTECSEA's major areas of expertise include deepwater subsea and floating production systems, marine pipeline and riser systems, Arctic pipelines, marine terminal systems, and Arctic structures. Additional areas of expertise include flow assurance and operability, marine surveys, marine operations, and offshore equipment design.

A History of Innovation and Benchmark Achievements…

SUBSEA

- Deepest Subsea Production
- Longest Oil Tieback
- Longest Gas Tieback
- First Subsea Allocation Flow Meters
- First 15,000 psi Subsea Trees
- First Electrically Heated Pipe-in-Pipe Flowlines
- Deepest Multiphase Subsea Pumps
- First Super Duplex Umbilical
- First Diaphragm Chemical Injection System

RISERS

- First Pipe-in-Pipe Steel Catenary Riser
- First Reeled Steel Catenary Riser
- Deepest Steel Catenary Risers
- Most Shallow Catenary Riser
- Largest Diameter Flexible SCR Joint
- First SCRs on an FPSO
- Most Direct Vertical Access Risers
- First GOM Free-Standing Riser

FLOATING SYSTEMS

- Largest FPSO
- Deepest TLP at Time of Installation
- Deepest SPAR at Time of Installation
- Most Installed TLPs
- First Deepwater FPU Operated with a Drilling Tender
- Most Types of Floating Systems

MARINE PIPELINES

- Deepest S-lay Pipeline
- Deepest J-lay Pipeline
- Longest Offshore Pipeline
- First Offshore Arctic Pipeline
- First Arctic Pipeline Leak Detection System
- First Piggable Wyes
- First Arctic Pipeline Bundle

(for more capabilities information click here)

INTECSEA
WorleyParsons Group

Global Reach,
Local Knowledge,
Global Solutions

For further information about
our global capability, email
info@intecsea.com

www.intecsea.com