

MAREAL – CETEAL

STRUCTURAL ENGINEERING



MAREAL IS AN INDEPENDENT STRUCTURAL ENGINEERING COMPANY

MAREAL is CETEAL's Mother Company

Overview

References

Partnerships

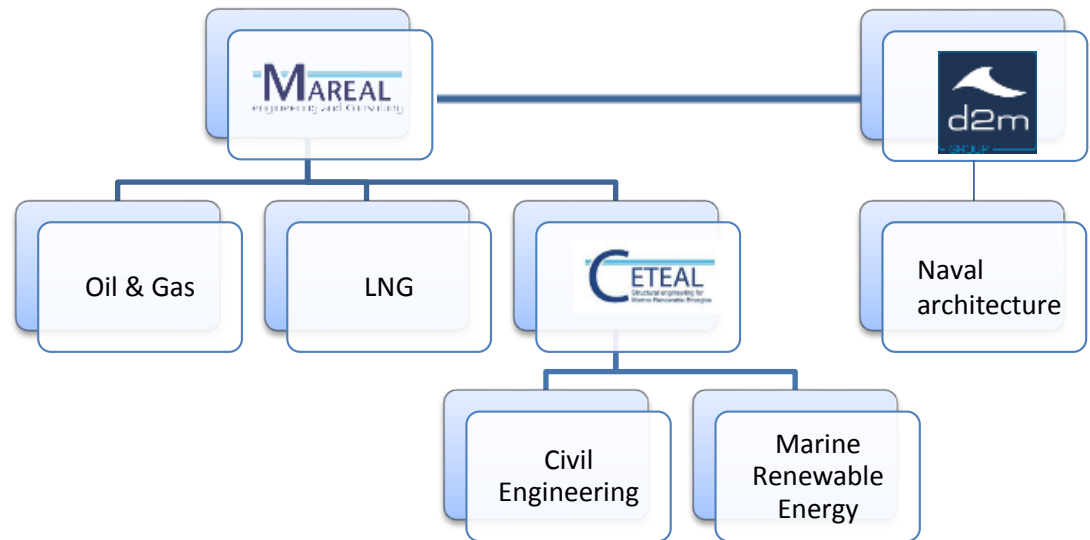
Innovation

- Founded in 2002, MAREAL is specialized in the design and analysis of offshore structures for the Oil & Gas and LNG sectors
- Since 2011, MAREAL has been involved in marine energy projects through its subsidiary CETEAL for the design of steel and concrete foundations for tidal and offshore wind energy projects
- MAREAL is part of the D2M group since October 2016

Let's talk numbers

- 25 engineers & draftmen
- 39,000 manhours/year
- International team with 10 possible working languages

French, English, Russian, Chinese, Spanish, Arabic, Vietnamese, Polish, Portuguese, Persian



OUR SERVICES ENSURE PROFITABILITY AND RELIABILITY OF PROJECTS WHILE REDUCING ALL RISKS

Overview

References

Partnerships

Innovation

FEED & Basic Engineering

- Conceptual studies
- Feasibility studies
- Basic engineering

Execution Engineering

- Sizing of foundations
- Cost estimate
- Construction drawing
- Certification plan

Third part

- Third part
- Expertise
- Survey

« We work with all kinds of foundations: concrete, steel or hybrid structures, fixed or floating »



CAPABILITY STATEMENT

Our numerical modeling capabilities enable us to perform specialized studies and offshore engineering

Overview

References

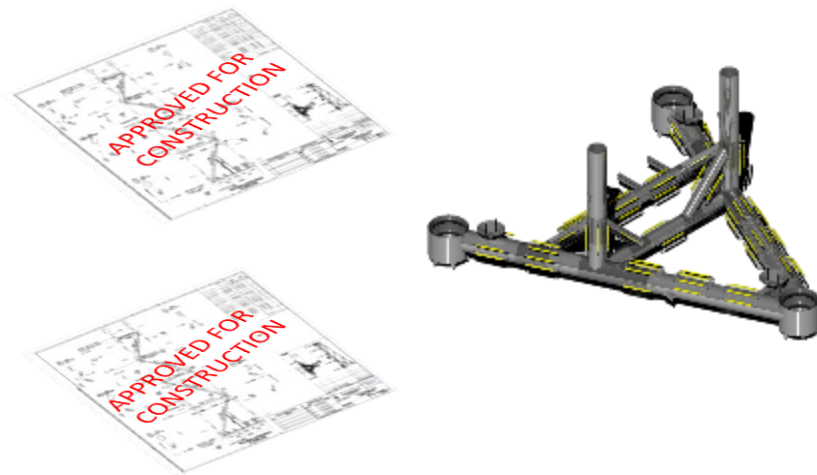
Partnerships

Innovation

CONCEPTION

Design of platforms

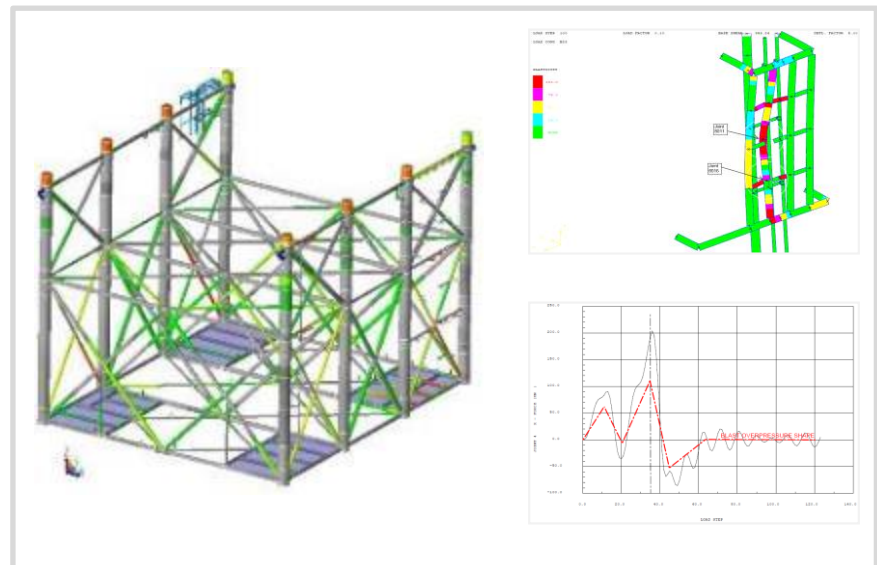
- Feasibility study, FEED, basic, detailed engineering
- 3D model, drafting, MTO, WCR
- Offshore platform, fixed or floating, jetty, etc.



ANALYSIS

Special and ultimate conditions

- Installation and service
- Fatigue, earthquake (SLE and DLE)
- Push-over, ship impact, dropped object
- Blast, fire, wave in deck



OUR ENGINEERS CAN WORK WITH MULTIPLE SOFTWARE AND ARE REGULARLY TRAINED IN THE NEW TECHNIQUES

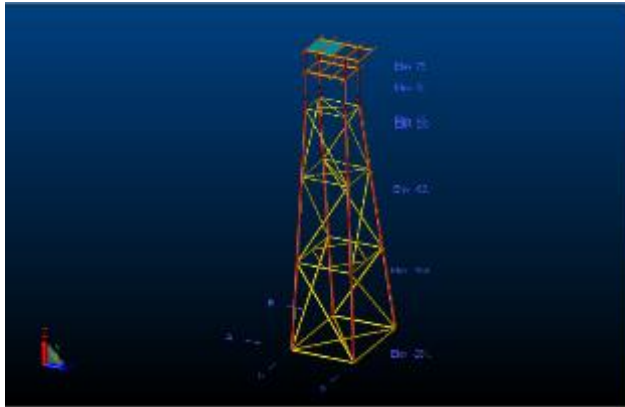
Overview

References

Partnerships

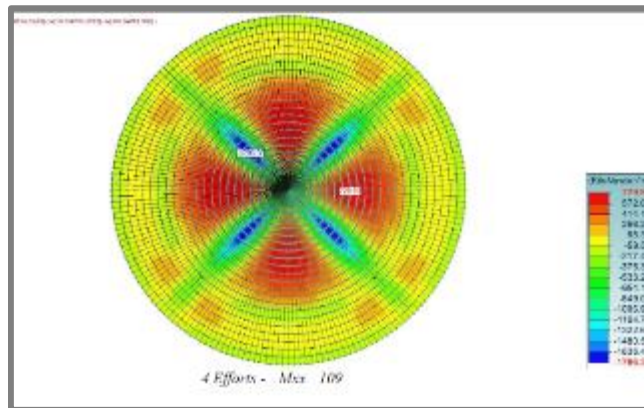
Innovation

Structure Analysis



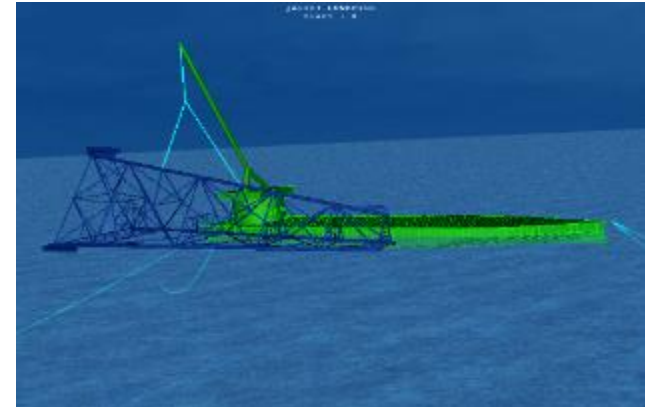
STAAD Pro, SACS et NSO

Finite Element Analysis



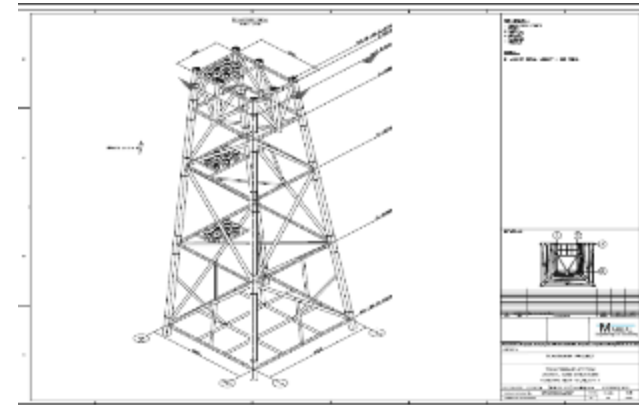
STAAD PRO, ABAQUS

Hydrodynamic and structural analysis of floating and gravity base platforms



MOSES

Construction drawings



TEKLA, AUTOCAD 3D

WORKING WITH MAREAL IS A GUARANTEE OF QUALITY AND EXPERIENCE

Overview

- Our Quality System Management is **ISO 9001:2008** certified
- As an **independent** consultancy, we put our reputation at stake during every stage of a project. Our **flexibility** and close involvement with clients allow us to maintain a results-driven approach
- As engineers, our approach is based on intelligence from **experience** and **know-how**, using modeling and numerical analysis as a tool and a technical support
- We integrate **optimization** in our service standards to contribute to the **performance** and **profitability** of our customers
- We integrate **standards** from multiple classification societies
- MAREAL is the Bentley SACS **technical partner**, software specialist and unique European trainer for SACS – the reference software for structural analysis for the wind energy and the oil & gas offshore industry



References

Partnerships

Innovation

MAREAL & CETEAL ENJOY A SOLID TRACK RECORD

We provide expertise to many kinds of clients

Overview

References

Partnerships

Innovation

MAREAL REFERENCES



CETEAL REFERENCES



Several references on complex and international projects in several fields focused on offshore energy projects allowed MAREAL to demonstrate its technical expertise

Today, MAREAL wants to expand to the North Sea with CETEAL, to strengthen existing relationships and create new partnerships and opportunities

JACKETS, TOPSIDES, JETTIES AND PLATFORMS

Through its projects diversity, MAREAL proved its capacity to provide expertise throughout a project's life

Overview

References

Partnerships

Innovation

Project	Customer	Description	Year
JOHAN SVENSDRUP	Dragados Offshore	Unmanned Wellhead Platform	Ongoing
HA LITORAL LQ	Dragados Offshore	Float-over jacket detailed engineering	2015
OSEBERG	Dragados Offshore	Wellhead platform FEED engineering	2015
AMAL	Aquaterra	Platform structural detailed design	Ongoing
CORAL FLNG	SOFRESID	Structural design of technical rooms	2015
	Saipem	S1 module structural design	2015
		Fire protection optimization	2015
		Piperack structure design	2015
FRANKLIN	Technip	Working instruction for complex rigging module lifting	2015
YAMAL	Technip	Yard and construction follow-on	Ongoing
		Modular plant structural detailed engineering	2014-2015
ANVERS OLEFINS	Total	Consultancy for cryogenic tank conversion	Ongoing
ARKONA BECKEN	Dragados Offshore	Jacket structure design for tender	2015
VEGA PLEYADE		Jacket and topside structural detailed engineering	2014-2015
TIKO wellhead	Perenco	Platform structural detailed design	2013-2014
SEASWIFT	Aquaterra	Platform structural detailed design	2013 – 2014
ABK AKC	TOTAL	Platform strength reassessment	2013

REFERENCE PROJECTS (OIL & GAS SECTOR)

MAREAL knows how to adapt to hostile terrain (water depth, waves, wind, soils)

Overview

References

Partnerships

Innovation

VEGA PLEYADE Wellhead Platform [2013 – 2015 / Argentina]

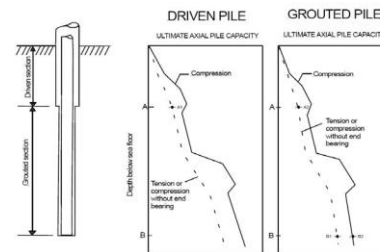
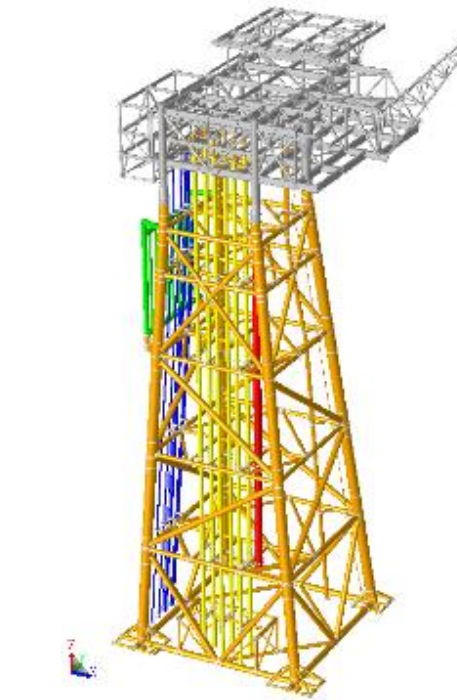
CLIENTS



ACHIEVEMENT

Detail engineering of a wellhead platform (topside + jacket) with 52,5m water depth. This platform consists of a four-legged topside, supported by piles driven through a four-legged jacket structure.

- **Pre-service analyses** (loadout, Sea-transportation, lifting)
- **In-service analyses** (In place, earthquake, fatigue, boat impact)
- **Local checks**
- **Detail drawings**



Project characteristics	
✓	Oil & Gas
	Marine Renewable Energies
	LNG
	Civil Engineering
✓	Offshore structure
	Onshore structure
✓	Support/foundation
✓	Topside
	Onshore facility
	Subsea
	Harbour/jetty
	T&I
	Other
✓	Steel structure
	Concrete Structure
	Composite structure
	Feasibility / Conceptual
	Basic engineering / FEED
✓	Detail engineering
	Tender design
	Third Part / Expertise
	Reassessment

SEME Field – SEASWIFT platform [2013 – 2014 / Benin]

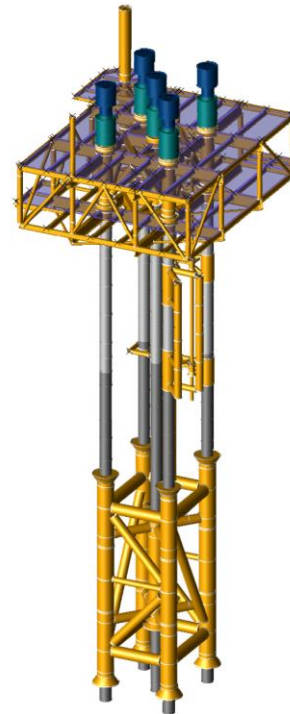
CLIENTS



ACHIEVEMENT

Detail engineering of a fixed conductor supported platform structure including :

- **Pre-service analyses** (loadout, Sea-transportation, lifting)
- **In-service analyses** (In place, fatigue, boat impact)
- **Local checks**
- **Detail drawings**



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REFERENCE PROJECTS (OIL & GAS SECTOR)

MAREAL had to adapt to Russian rules and specific climate for the planning of the project

Overview

References

Partnerships

Innovation

YAMAL LNG PLANT [2014-2016 / Russia]

CLIENTS

Technip



NOVATEK

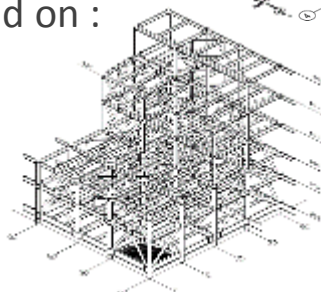
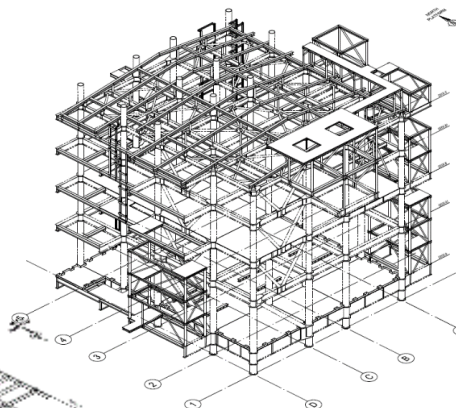
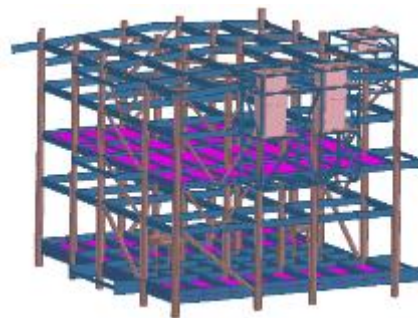
ACHIEVEMENT

Detail engineering of 4 modules :

- **2 fast-track modules** (111-PAU-003 & 146-PAU-001)
- **2 HVAC modules** (114-PAU-016 & 114-PAU-026)

In place, land-transportation and sea-transportation analysis performed on :

- **Primary structure**
- **Secondary structure**
- **Pipe supports**
- **Cladding**
- **HVAC supports**



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AMAL - SEASWIFT platform [2015 / Libya]

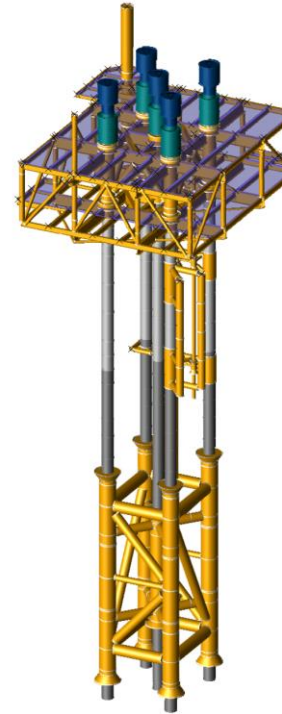
CLIENTS



ACHIEVEMENT

Detail engineering of a fixed conductor supported platform structure including :

- **Pre-service analyses** (loadout, Sea-transportation, lifting)
- **In-service analyses** (In place, fatigue, boat impact)
- **Local checks**
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REFERENCE PROJECTS (OIL & GAS SECTOR)

MAREAL had to take into account the platformy history and come up with a critical analysis

Overview

References

Partnerships

Innovation

GORGON [2010 – 2012 / Australia]

CLIENTS



Kellogg Joint Venture Gorgon

KBR UGC HATCH CLOUGH



ACHIEVEMENT

- Analyses, construction drawings, MTO, WCR on jetty pipeways



Project characteristics

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YADANA QP2 & WP2 [2013 / Myanmar]

CLIENTS



ACHIEVEMENT

Structural analyses for the reassessment of two jackets and topsides



Project characteristics

✓	Oil & Gas
	Marine Renewable Energies
	LNG
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✓	Reassessment

REFERENCE PROJECTS (OIL & GAS SECTOR)

MAREAL assigned an engineer in Angola to take the leadership of a team

KAOMBO - Subsea Structure Installation [2015 – 2016 / Angola]

Overview

CLIENTS



References

ACHIEVEMENT

- **Rigging arrangement** design during **transportation and installation**
- **Sea-fastening** design for LRA and FLETs (3 types)
- More than **400** subsea structure objects
- **Lifting analysis** for Clov project Jumpers.



Project characteristics

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	Reassessment

REFERENCE PROJECTS (OIL & GAS SECTOR)

MAREAL had to take into account the platformy history and come up with a critical analysis

Overview

References

Partnerships

Innovation

BONGKOT Reassessment [2013 – 2014 / Thailand]

CLIENTS

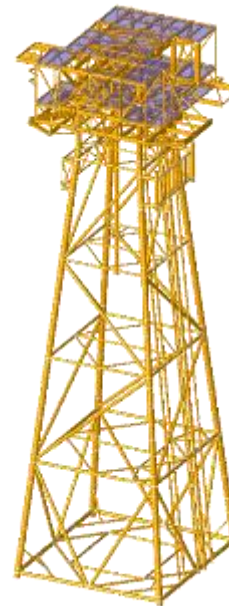
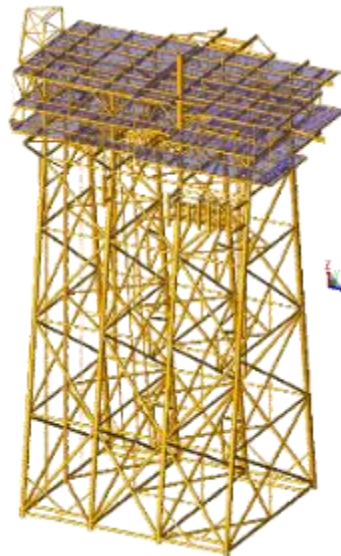


TOTAL



ACHIEVEMENT

In-service analyses for the reassessment of jackets



Project characteristics

✓	Oil & Gas
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✓	Reassessment

MARINE RENEWABLE ENERGY

Through its projects diversity, CETEAL proved its capacity to provide expertise throughout a project's life

Overview

References

Partnerships

Innovation

Project	Customer	Description	Year
Megawattblue	Guinard Energies	Tidal Turbine foundation – dynamic analyses	Ongoing
Raz Blanchard	Open Hydro	Preliminary design of standard subsea base	2016
R&D	CFMS	Guidance note for geotechnical design for OWT foundation on the French coast	Ongoing
Confidential	Confidential	Basic engineering of monopiles for wind turbines	Ongoing
Paimpol Bréhat	DCNS	Electrical cable arms	2015
	Open Hydro	Basic and Detailed engineering of tidal turbine subsea base	2015
Bay of Fundy (Canada)	Open Hydro	Basic and Detailed engineering of tidal turbine subsea base	2015
Offshore wind	Bouygues TP	Conceptual study (confidential)	2014
Fécamp	EDF EN	FEED analysis of GBS wind turbine foundations	2013
Le Raz Blanchard	DCNS	Conceptual analyses of tidal turbines subsea bases and substation foundations	2013
Fort Boyard	CG Charente Maritime	Survey and reassessment of jack-up logistic platform and basic engineering for new platform	2013
Confidential	DONG	FEED analysis of GBS wind turbine foundations	2013
Confidential	EDF EN	Conceptual analysis of GBS wind turbine foundations	2013
TGL electric hub	Alstom	Conceptual studies for a subsea substation	2013
Passage du Fromveur	Sabella	Basic engineering of a tidal turbine subsea base – concrete and steel solutions	2012

REFERENCE PROJECTS (MRE SECTOR)

CETEAL worked on the FEED of Fécamp, in team with COWI (danish company)

Overview

References

Partnerships

Innovation

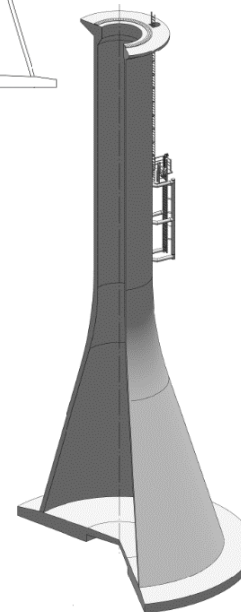
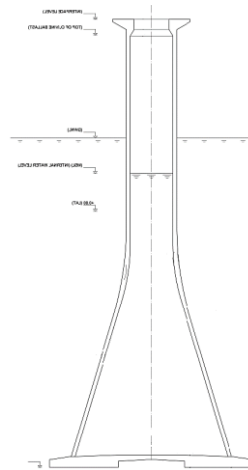
FECAMP – GBS Wind turbine foundations [2014 / France]

CLIENTS



ACHIEVEMENT

- **Partnership with COWI**
- Study of **3 GBS concepts** according to installation methodology
- Recommendation for the **more competitive GBS solution** with the corresponding installation procedure, construction methodology and quay layout in order to fulfil the overall project schedule
- **Quay reinforcement design**
- **Cost analysis**



Project characteristics

	Oil & Gas
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	Tender design
	Third Part / Expertise
	Reassessment

CETEAL can work with different kind of foundations and comes up with innovative solutions

Overview

References

Partnerships

Innovation

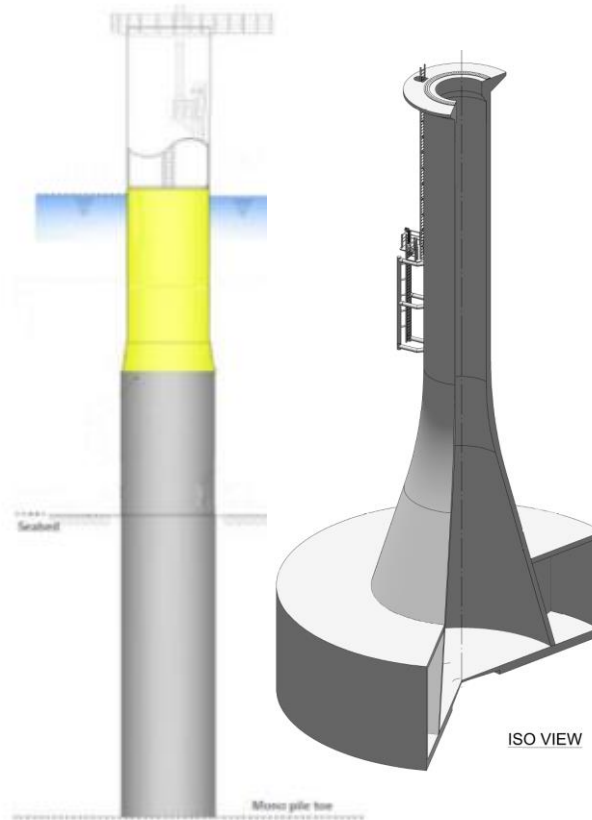
X site – Secondment on wind turbine foundation [2015 /

Denmark]
CLIENTS

Confidential client

ACHIEVEMENT

- **Monopile & Gravity base** tender designs
- **Stability analysis** for concrete gravity bases
- **Structural and modal analysis** for steel monopile solution
- **3 environmental scenarios** for each type of foundation
- **3 turbines** per scenario
- **4 sites** studied



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	Reassessment

[illegible]

REFERENCE PROJECTS (MRE SECTOR)

CETEAL has very accurate modelling capabilities

Overview

References

Partnerships

Innovation

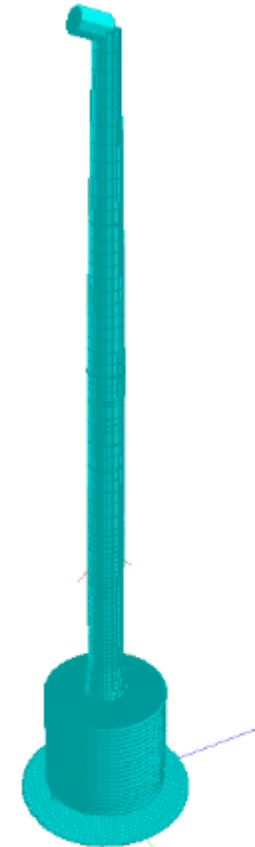
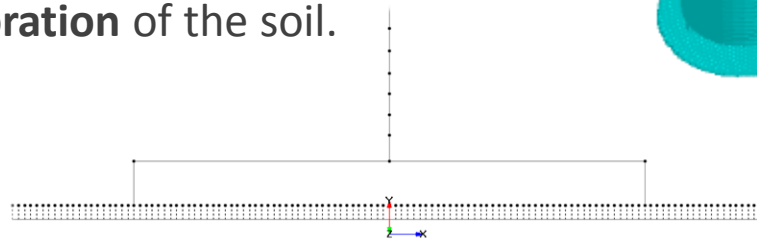
X Site - GBS Dynamic analysis [2015 / France]

CLIENTS

Confidential client

ACHIEVEMENT

- **Dynamic analysis** on existing concept to make sure that the structure's natural frequencies avoid harmonic frequencies of the wind turbine
- **2-D stick model** and geotechnical parameters that take into account the **cyclic deterioration** of the soil.



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	Reassessment

REFERENCE PROJECTS (MRE SECTOR)

CETEAL can work till the finest detail of the structure

SUBSEA HUB – Grouted connection [2015 / France]

Overview

References

Partnerships

Innovation

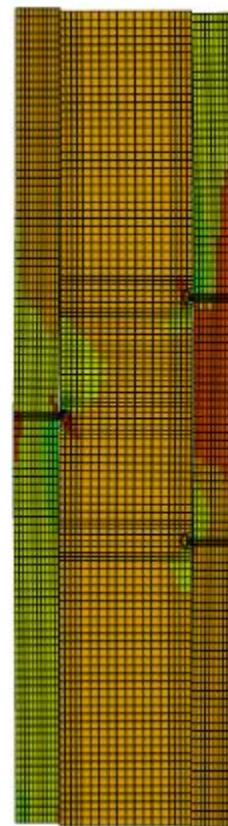
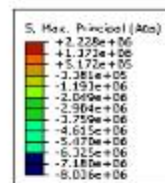
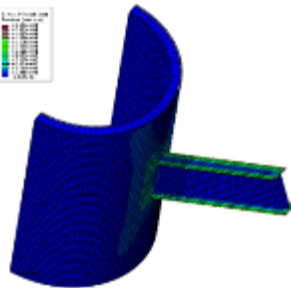
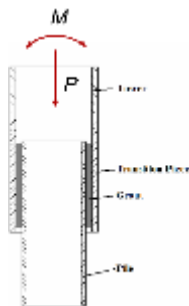
CLIENTS



ALSTOM

ACHIEVEMENT

- **Development of local models** with ABAQUS to estimate the SCFs factors in the connection
- **Evaluation of existing design** (in-place, fatigue)
- **Design optimization**
- **Detailed design** of the proposed solution (in-place, fatigue)



Local models developed with ABAQUS

Project characteristics

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REFERENCE PROJECTS (MRE SECTOR)

CETEAL can work from the very beginning of a project to choose a material

Overview

References

Partnerships

Innovation

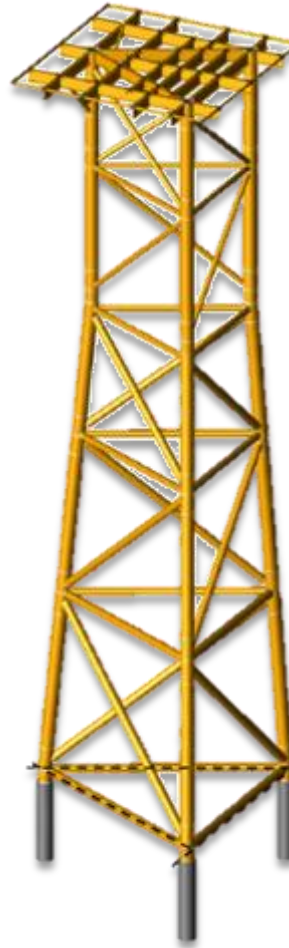
X site – Met Mast [2015 / France]

CLIENTS

Confidential client

ACHIEVEMENT

- **Monopile & Jacket** tender designs
- **In place** strength and displacement **analysis** under environmental conditions
- **Design optimization**
- **Two-parts jacket** analysis
- **Cathodic protection** design
- **MTO**



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REFERENCE PROJECTS (MRE SECTOR)

CETEAL is used to working with third companies or partners

Overview

References

Partnerships

Innovation

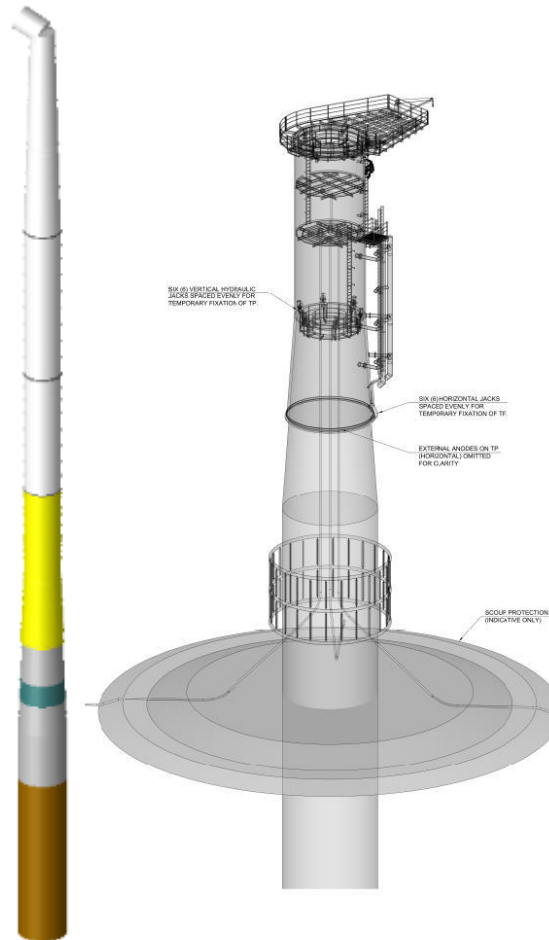
NORTH SEA – Secondment on WT foundation [2015 / Netherlands]

CLIENTS

Confidential client

ACHIEVEMENT

- **Monopiles** tender design
- **Structural and modal analysis**
- **Spectral fatigue analysis**
- **3 environmental scenarios**
- **2 iterations** to refine the turbine loads and consequently the design (**Preliminary** and **Basic** design)



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REFERENCE PROJECTS (MRE SECTOR)

CETEAL had to deal with the strongest currents in the world

NOVA SCOTIA – Tidal turbine subsea base [2014-2015 / Canada]

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Partnerships

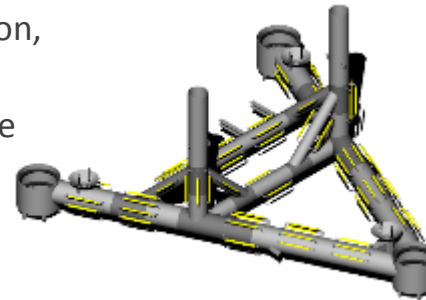
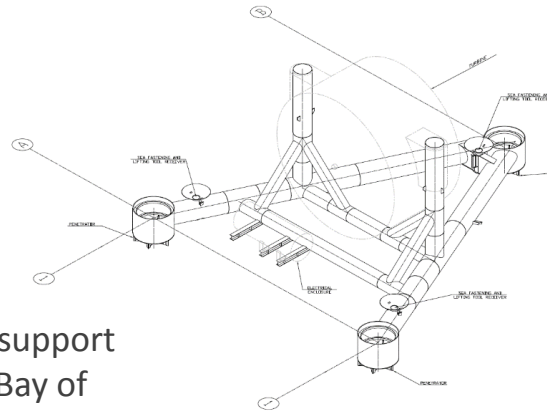
Innovation

CLIENTS



ACHIEVEMENT

- Detailed design of a gravity base structure to support the OPENHYDRO Pre-Series 2 turbine for the Bay of Fundy (Canada):
- Preliminary **comparative study** between several subsea base concepts (concrete structure, steel structure with ballast material, hybrid structure) based on the main project key points (installation procedure, construction, material cost).
- **Detailed design** of the selected subsea base : In-Place strength and stability analysis, fatigue analysis, transportation analysis, lifting/Lowering analysis, penetrator design and cathodic protection
- **Design optimization** to fulfil the installation requirement
- **Construction drawings**



Project characteristics

	Oil & Gas
✓	Marine Renewable Energies
	LNG
	Civil Engineering
✓	Offshore structure
	Onshore structure
✓	Support/foundation
	Topside
	Onshore facility
✓	Subsea
	Harbour/jetty
	T&I
	Other
✓	Steel structure
	Concrete Structure
	Composite structure
	Feasibility / Conceptual
✓	Basic engineering / FEED
✓	Detail engineering
	Tender design
	Third Part / Expertise
	Reassessment

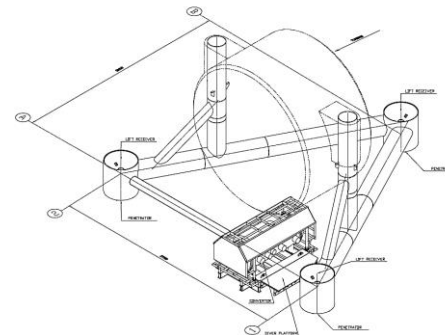
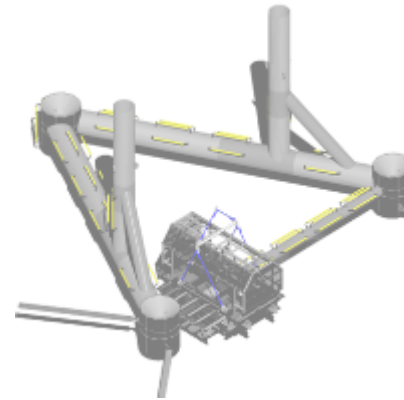
PAIMPOL BREHAT – Tidal turbine subsea base [2014-2015 / France]

CLIENTS



ACHIEVEMENT

- Detailed design of a gravity base structure to support the OPENHYDRO Pre-Series 2 turbine for the Paimpol Brehat site (France):
- **Basic and detailed design** of the selected subsea base : In-Place strength and stability analysis, fatigue analysis, transportation analysis, lifting/Lowering analysis, penetrator design and cathodic protection
- **Design optimization** to fulfil the installation requirement
- **Construction drawings**



Project characteristics

	Oil & Gas
✓	Marine Renewable Energies
	LNG
	Civil Engineering
✓	Offshore structure
	Onshore structure
✓	Support/foundation
	Topside
	Onshore facility
✓	Subsea
	Harbour/jetty
	T&I
	Other
✓	Steel structure
	Concrete Structure
	Composite structure
	Feasibility / Conceptual
✓	Basic engineering / FEED
✓	Detail engineering
	Tender design
	Third Part / Expertise
	Reassessment

REFERENCE PROJECTS (MRE SECTOR)

Interface project between the foundation and the electrical design

PAIMPOL BREHAT – Tidal turbines connection [2015 / France]

Overview

References

Partnerships

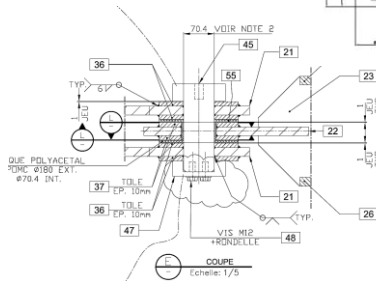
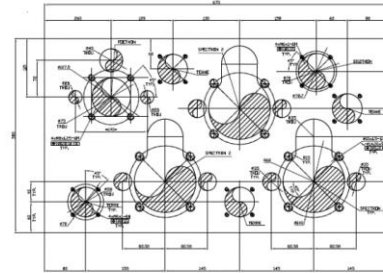
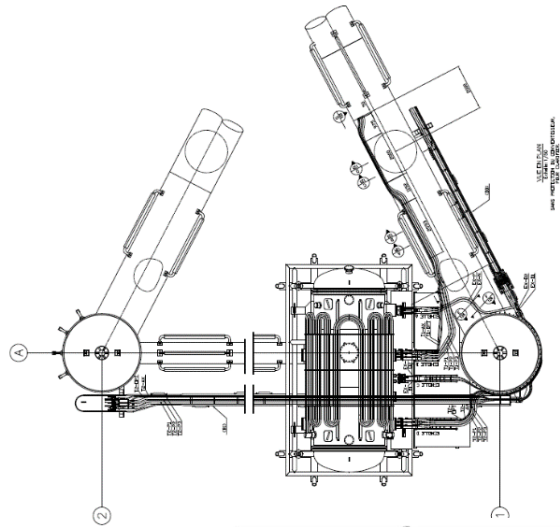
Innovation

CLIENTS



ACHIEVEMENT

- Detail design of **3 articulated arms** dedicated to the connection of the turbines on the converter and to the grid.
- **In place** analysis under **extreme environmental conditions**
- **Local designs** of articulations, supports, connections
- **Cathodic protection** analysis
- **Optimization** of the concept defined by DCNS
- **VIV** Mitigation justification



Project characteristics

	Oil & Gas
✓	Marine Renewable Energies
	LNG
	Civil Engineering
✓	Offshore structure
	Onshore structure
	Support/foundation
	Topside
	Onshore facility
	Subsea
	Harbour/jetty
	T&I
✓	Other
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	Concrete Structure
	Composite structure
	Feasibility / Conceptual
	Basic engineering / FEED
✓	Detail engineering
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	Reassessment

CIVIL ENGINEERING

Through its projects diversity, CETEAL proved its capacity to provide expertise throughout a project's life

Overview

References

Partnerships

Innovation

Project	Customer	Description	Year
FÉCAMP	EDF EN	FEED analysis of GBS wind turbine foundations	2013
Reinforcement ALGECO	CTE	Bureau d'ingénierie de structure CTE	Ongoing
Mezzanine Mango Meaux	GVA	Générale Vosgienne d'Agencement	2015
Microtunnel A36	CAB	Communauté de l'Agglomération Belfortaine	2016
	BEJ	BUREAU D'ETUDES JACQUET	2016
Reinforced concrete wall verification	AE2	AE2 is an engineering company performing installation and industrial maintenance	2016

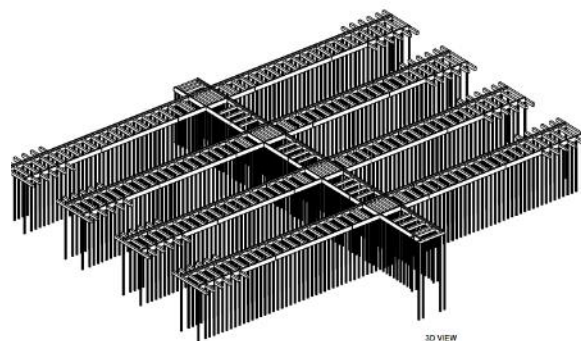
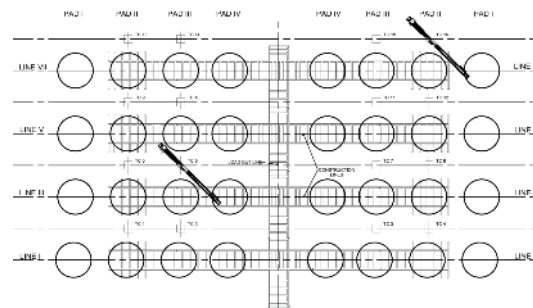
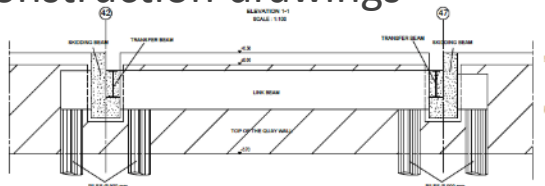
FECAMP – Quay reinforcement for GBS construction [2014 / France]

CLIENTS



ACHIEVEMENT

- Quay reinforcement design
- Design of the reinforced concrete structure support
- Design of the piles
- Design of the steel elements.
- **Cost analysis**
- Construction drawings



Project characteristics

	Oil & Gas
✓	Marine Renewable Energies
	LNG
✓	Civil Engineering
	Offshore structure
✓	Onshore structure
	Support/foundation
	Topside
	Onshore facility
	Subsea
✓	Harbour/jetty
	T&I
	Other
✓	Steel structure
✓	Concrete Structure
	Composite structure
	Feasibility / Conceptual
✓	Basic engineering / FEED
	Detail engineering
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	Third Part / Expertise
	Reassessment

REFERENCE PROJECTS (CIVIL ENGINEERING SECTOR)

CETEAL can work with different kind of foundations and comes up with innovative solutions

Overview

References

Partnerships

Innovation

NRL - Anti-scouring expertise [2016 / France]

CLIENTS

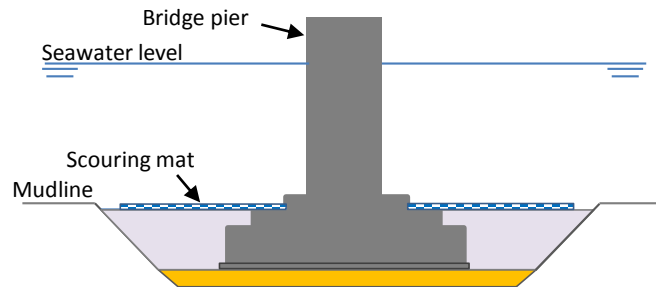


d2m Engineering
KNOWLEDGE. INNOVATION. SERVICE



ACHIEVEMENT

- Studying the **anti-scouring** mat life-time
- Checking of steel wire and fiber ropes against **environmental loads**
- Checking integrity of steel wire and fiber ropes against **damages**
- Checking of concrete blocks against **environmental loads**



New coastal road bridge project: La Réunion, France

Project characteristics

	Oil & Gas
	Marine Renewable Energies
	LNG
✓	Civil Engineering
	Offshore structure
✓	Onshore structure
✓	Support/foundation
	Topside
	Onshore facility
	Subsea
✓	Harbour/jetty
	T&I
	Other
	Steel structure
✓	Concrete Structure
	Composite structure
	Feasibility / Conceptual
	Basic engineering / FEED
	Detail engineering
	Tender design
✓	Third Part / Expertise
	Reassessment

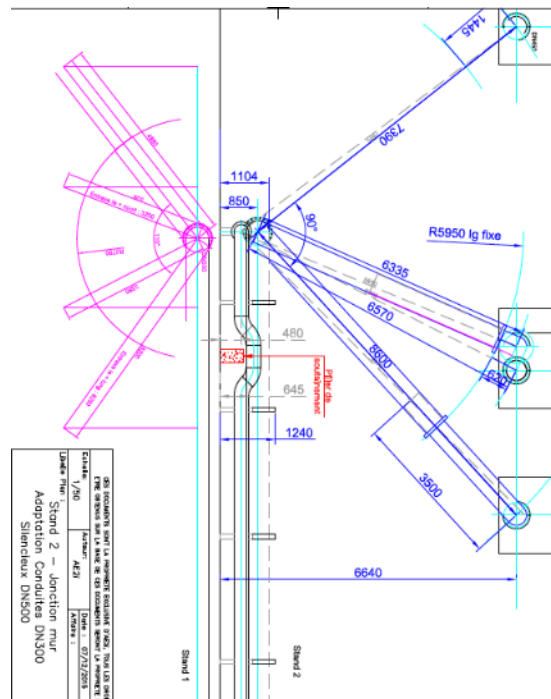
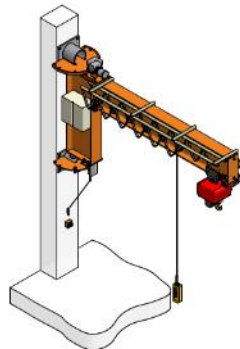
HIRSINGUE – Davit fixation [2016 / France]

CLIENTS



ACHIEVEMENT

- Design of the fixation on the wall
- Survey of reinforcement steel
- Survey of concrete strength



Project characteristics

Oil & Gas
Marine Renewable Energies
LNG
✓ Civil Engineering
Offshore structure
✓ Onshore structure
Support/foundation
Topside
Onshore facility
Subsea
Harbour/jetty
T&I
✓ Other
Steel structure
✓ Concrete Structure
Composite structure
Feasibility / Conceptual
Basic engineering / FEED
Detail engineering
Tender design
✓ Third Part / Expertise
Reassessment

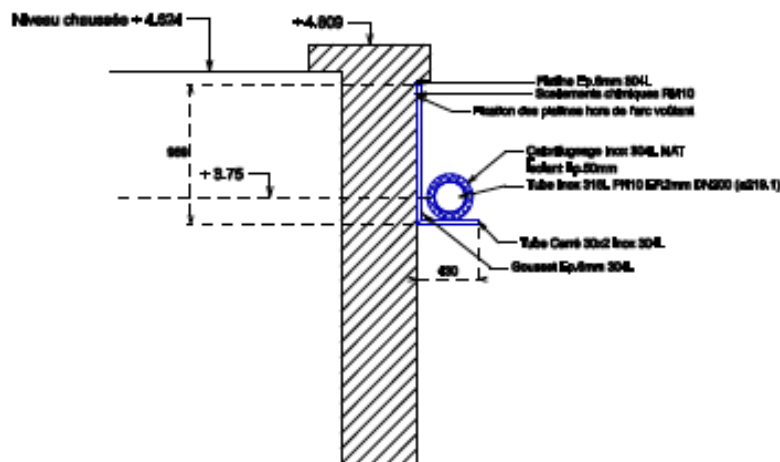
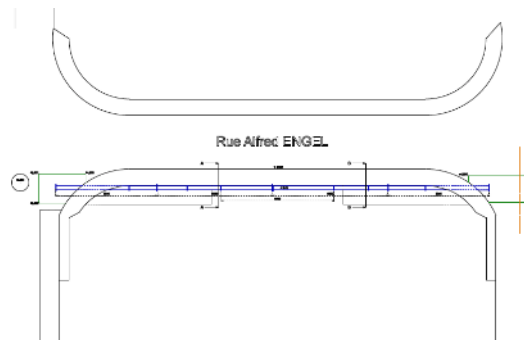
BELFORT - Fixation of pipes on SNCF railway bridge [2016 / France]

CLIENTS



ACHIEVEMENT

- Third part on **execution documents**



Project characteristics

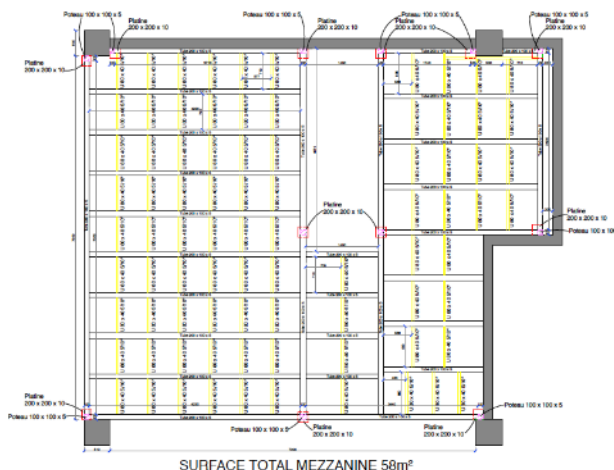
	Oil & Gas
	Marine Renewable Energies
	LNG
✓	Civil Engineering
	Offshore structure
✓	Onshore structure
	Support/foundation
	Topside
	Onshore facility
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	T&I
✓	Other
	Steel structure
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	Composite structure
	Feasibility / Conceptual
	Basic engineering / FEED
	Detail engineering
	Tender design
✓	Third Part / Expertise
	Reassessment

CLIENTS

GVA Peltier
Générale Vosgienne d'Agencement

ACHIEVEMENT

- Steel structure calculation



Project characteristics	
	Oil & Gas
	Marine Renewable Energies
	LNG
✓	Civil Engineering
	Offshore structure
✓	Onshore structure
	Support/foundation
	Topside
	Onshore facility
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	Concrete Structure
	Composite structure
	Feasibility / Conceptual
	Basic engineering / FEED
✓	Detail engineering
	Tender design
	Third Part / Expertise
	Reassessment

Project	Customer	Description	Year
KIZOMBA-A	SAIPEM	Detail design of installation aids	2003
FDS J-LAY TOWER UPGRADE	SAIPEM	Validation of the as-built conditions, assessment of the upgrading feasibility including fatigue consideration and design of reinforcements	2005
ROSA	SAIPEM	Transportation and sea fastening of spool, jumper, manifold, reels	2007
MARIMBA	SAIPEM	Transportation and sea fastening of spool, jumper, manifold, reels	2007
AKPO-C	SAIPEM	Transportation, sea fastening and lifting analysis of spool and jumper	2008
BLOCK 17 GAS EXPORT PIPELINE – PHASE 1	SAIPEM, TOTAL	Feasibility study of the upgrade of a stinger related to the specific conditions of the GEP Block 17 pipeline installation	2008
URUGUA/PMXL-1 EXPORTATION PIPELINE	SAIPEM	Design of the sea-fastening for subsea equipment sea transportation	2010
550T PLSV – Tower Structure	REEL/IMECA, TECHNIP, DSME	Basic end Detail design of the DSME 550T capacity Pipelay Tower for the installation of flexible sealine in Santos Basin BM-S Cluster (Brazil)	2012
McDERMOTT LV108	REEL/IMECA, McDERMOTT	Basic end Detail design of the LV108 J-Lay tower	2013
BONGA NORTH WEST FIELD DEVELOPMENT PROJECT	ERM-S, SAIPEM	Design of temporary holding clamps for the installation of umbilical lines	2013
ANGOLA BLOCK - ENI WEST HUB	DORIS	Design of the sea-fastening (including lashing system) for subsea equipment sea transportation	
MARINER JACKET & PILES SEA-FASTENING	DRAGADOS, STATOIL	Optimization of the grillage and sea-fastening for the jacket (22400 T) and piles sea transportation to the installation site	2015

Work Experience

Basic and detailed engineering analyses, including:

- In-service strength analysis
- Fatigue analysis
- Pre-service analyses
- Basic and construction drawings



Project characteristics

✓	Oil & Gas
	Marine Renewable Energies
	LNG
	Civil Engineering
✓	Offshore structure
	Onshore structure
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✓	Detail engineering
	Tender design
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✓	Reassessment

CLIENTS



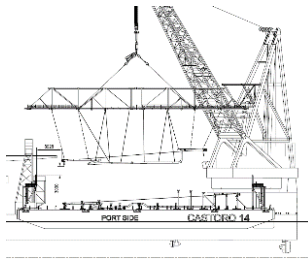
Saipem



Work Experience

Basic and detailed engineering analyses, including:

- Transportation and Sea-fastening
- Lifting (Air lift, lowering in water and splash zone crossing)
- Determination of rigging configuration
- Displacements and end orientations at touch-down



CLIENTS



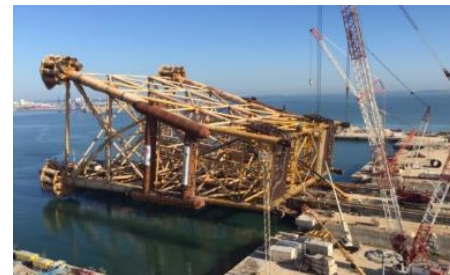
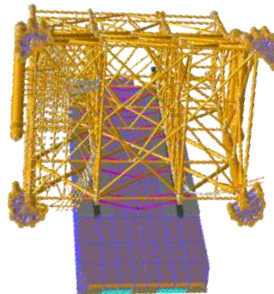
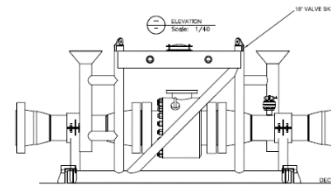
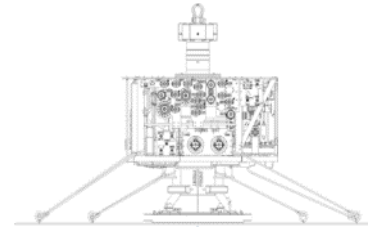
Saipem

Project characteristics	
✓	Oil & Gas
	Marine Renewable Energies
	LNG
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	Concrete Structure
	Composite structure
	Feasibility / Conceptual
✓	Basic engineering / FEED
✓	Detail engineering
	Tender design
	Third Part / Expertise
	Reassessment

Work Experience

Basic and Detail engineering (including analyses and drawings) of the grillage & sea-fastening for:

- Heavy items (500 T ~ 25000 T) rigidly secured on the barge → jackets, modules, bridges and others offshore and onshore components on towed barges, ships, vessels...
- Light items secured by wires lashing, stoppers,...



Project characteristics

✓	Oil & Gas
	Marine Renewable Energies
	LNG
	Civil Engineering
✓	Offshore structure
	Onshore structure
	Support/foundation
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	Subsea
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	Reassessment

CLIENTS



Saipem



TOTAL



Dragados Offshore



Statoil

Overview

References

Partnerships

Innovation

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Partnerships

Innovation

Overview

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Partnerships

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Overview

References

Partnerships

Innovation

OUR SELECTED MAIN PARTNERS

Partnerships enable CETEAL to deal with projects requiring multidisciplinary competences

Overview







References

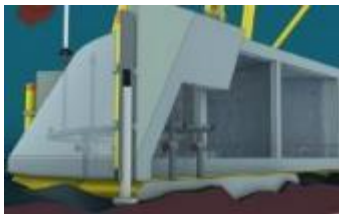
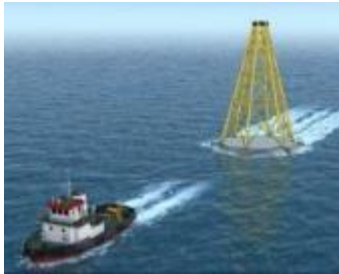
Partnerships

Innovation

As an independent engineering company specialized in structure analysis, MAREAL is at the connection to many disciplines and we work in close relationship with other consultancies, contractors, installers or EPCI.

SOME COMPANIES WE PARTNER WITH

	Naval architecture and marine operations
	Offshore geoscience and geotechnics
	Naval architecture and hydrodynamics.
	Offshore geoscience and geotechnics
	Process engineering
	Marine operations and foundation installation.



ROCKMAT, the foundation for rocky seabed

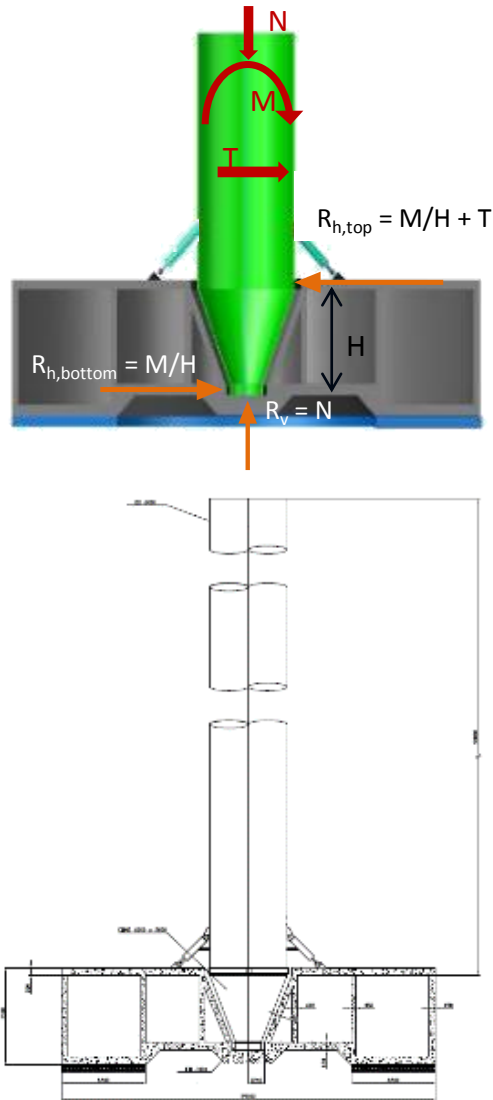
ROCKMAT is an innovative concept of offshore wind foundations adapted to rocky or uneven seabed. ROCKMAT is a patented technology for an interface between soil and a superstructure (jacket, monopile, concrete base). It consists of a smart combination of a grout injection system, associated to jack levelling system.

With no site preparation or drilling, ROCKMAT is a lower cost solution that can be implemented using only the local industry and at no cost to the marine environment.

- No site preparation;
- No costly lifting barge crane;
- Reversible water ballasting.

ROCKMAT has been patented by CETEAL, Cathie Associates (offshore geophysics and geotechnical) and DV Offshore (marine operations).

The video of the concept is viewable on www.rockmat.com



THE AXINBASE CONCEPT, a simple & low cost gravity base foundation

The AXINBASE foundation is a novel type of gravity base foundation based on an optimized combination of monopile and concrete caisson with patented smart connection

- The AXINBASE is a low cost gravity base foundation
- Simple design to construct
- Minimum marine operation means limited to tug boats and flat barges
- Relaxed soil preparation requirement

The AXINBASE concept has been developed and patented by Ceteal.

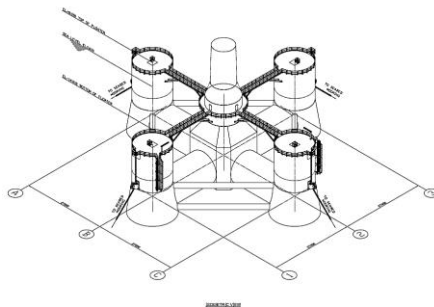
CETEAL is open to partner with a contractor



THE XCF-CONCEPT, a concrete floating structure to support wind turbines

The XCF structure is innovative concept for floating wind turbines in deep water which is a good compromise between construction and installation cost and sea-keeping.

- Structure designed to support extreme and fatigue loadings
- Simple design to construct
- Shaped to ensure sea-keeping and no additional disturbing loading



The AXINBASE concept has been developed and patented through a partnership between **CETEAL** and **Nass&Wind**.

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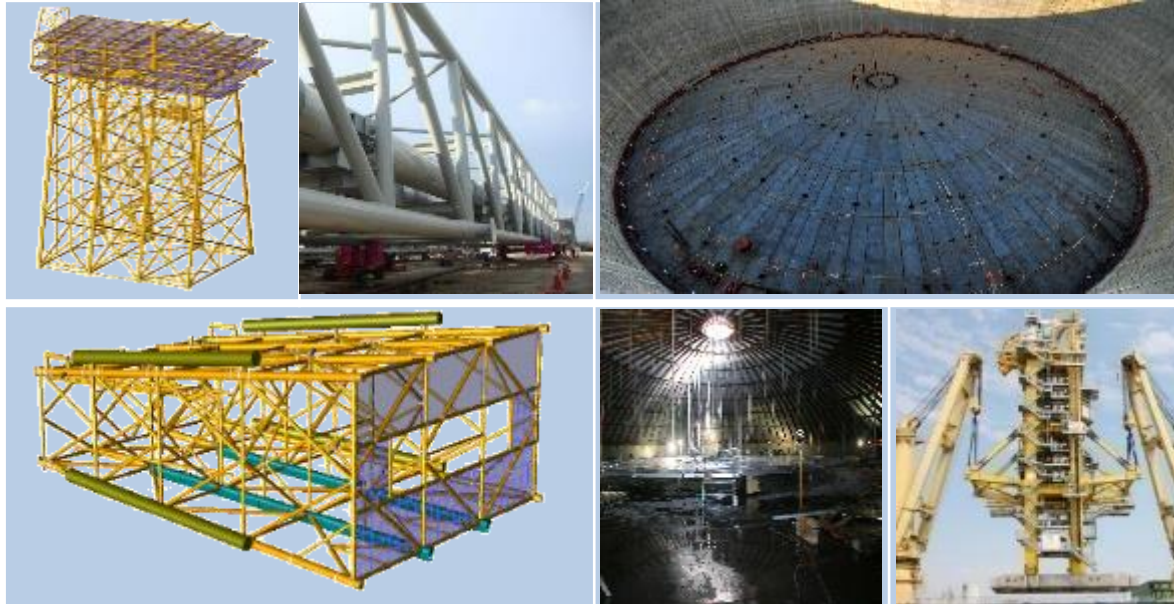


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**THANK YOU
FOR YOUR
ATTENTION**