



FLOATGEN is co-financed by the European Commission's 7th Framework Programme for Research and Technological Innovation.

The first Floating Wind Turbine in France (SEM-REV)



I. Le Crom, ECN, EERA Deepwind 19/01/2018



Offshore Wind Ressource in France





CENTRALE NANTES SEM·REV - LHEEA

BFOW: 1st Commercial Farms in France



FOW: 1st pre-Commercial Farms in France (EOLFLO)







CENTRALE NANTES and SEM-REV Test Site

- > LHEEA Laboratory
- > SEM-REV

Floatgen Project

- > Floatgen FWT
- > Status

LHEEA R&D Roadmap

- > Research Program
- > Feedback & Perspectives





CENTRALE NANTES & SEM-REV Test Site

Centrale Nantes

- Graduate engineering programs, Masters and PhDs, to French and international students (2000 students)
- Mechanics, Materials, Energy, Cybernetics, Architecture
- 250 teaching and research staff, 38 partners countries
- 50% R&D budget in collaborative projects with industry

« Widespread recognition of the institute by firms and R&D organizations has enabled graduates to assume positions of responsibility in every sector... »





LHEEA

Strategy to support R&D projects and technology development to make

the MRE economically viable

- By using large scale numerical and testing facilities
- Validation of numerical methods and model tests vs results in real conditions



SEM-REV : Overview









- General view of marine social sciences : consenting, permitting, environment, safety
- **Responsible for the procurement & installation of Electrical connection + Moorings**
- **Design by IDEOL**

Actual State

Instrumentation

> DWR West

Electrical Connexion

- > Export Cable
- > Junction Box
- > Hub
- > Umbilical

Moorings (6 lines)

> Drag embedded Anchor – chain -- synthetic rope)

Nord







Floatgen Project

Floatgen



FLOATGEN is co-financed by the European Commission's 7th Framework Programme for Research and Technological Innovation.

Industry-led European initiative

with partial public support

Demonstrate the technical and economic feasibility of one multi-MW integrated floating-wind turbine in the Atlantic Ocean conditions

Video

îdeol

CENTRALE NANTES

E ZODOLO Fraunhofer

BOUYGUES

FLOATGEN

IDEOL

Design: Floater, Umbilical Configuration & Moorings Pre-Lay Method & Hook-Up

<u>Bouygues TP</u> Floater Construction <u>ECN</u> Interface with Environment

Universität Stuttgart

Mooring System <u>Rotor</u> Ø = 80m <u>Wind Turbine</u> 2 MW

Floater concrete floating foundation (Damping Pool [®] system designed by Ideol) h = 9.5m, 36m wide Draught in place 7m

6 lines (drag embedded anchor-chainsynthetic rope)

Floatgen Installation



To do List

îde<mark>o</mark>l

ML Hook-Up

Umb Hook-Up

Instrumentation



Système de projection : UTM30

Auteur : SEMREV Centrale Nantes

Nord

Légende

- 2-years testing program connected to the grid : 2018-2019
- R&D on monitoring and fatigue life survey : mooring, cables...







R&D on floating wind turbines @ LHEEA Lab.

Supporting R&D

Collaborative projects with MRE industry

P1 : Marine environment and resources

- Environmental Monitoring : SEA-MON, MOSAIC
- Marine growth : ABIOP, LEHERO
- Soil mechanics : EOGP
- Environmental impacts : SPECIES

P2 : MRE Technologies (FOWT, WEC)

- Floating wind demonstration (FLOATGEN)
- FOWT components and Performances (FORESEA)

P3 : Energy Conversion, Transport and Storage

- Subsea connection units : HUB
- Export and Dynamic Cables : EMODI, OMDYN

P4 : Security, Safety, Marine operation

- Health Monitoring : MHM-EMR
- Marine operation and O&M : HUB installation























R&D P1 : Marine environment and resources

Environmental Monitoring Plan

Applied on Electrical Cables & Connections & Protections, Site & Demonstrators and Onshore Buildings...

Compulsory or Complementary Environmental Survey

Including Physical, Biological & Human Environment

- Marine life, Birds,
- Marine Growth
- Corrosion and Abrasion
- Anodes, Paints : water
- Bathymetry, sediments
- Power cables impacts
- Marine operations, O&M
- Marine traffic (risk an.)



Marine growth :

- Additionnal Mass
- Hydrodynamic Coeffi (drag/inert.)
- Development dissymmetry
- Species Identification
- Spatio-temporal Evolution





R&D P2 : MRE Technologies

Demonstration and Access to Market

FORESEA, MARINETII projects

FORESEA under Interreg NWE program

Supporting LCT developers to access NW Europe's test facilities

SMARTBAY

- SME / LCT : New Techno, PTO, Mooring, Umbilicals/connectors,
- Test sites benchmarking, Technologies vs market

CENTRALE NANTES SEM:REV - LHEEA

- From 02/2016 to 12/2019
- Co-Funding of testing cost up to 60%

MARINET 2 under H2020 Program

- Supporting MRE developers to access Europe's test facilities
- Funding : 100% of the test site cost (directly to the test site)

MARINERG-I / ESFRI : French national Research Infrastructure

• Ifremer + Centrale Nantes MRE testing facilities



Interreg

FORESEA

Europe

IHES /

IBOCS

DMEC

North-West Europe

Ocean Energy











R&D P3 : Energy Conversion, Transport and Storage

Power Cables monitoring : from cores to armors

OMDYN project

Dynamic cables: from cores to armors

- Mechanical charcateristics of cable components
- Loads, motions and deformations
- Influence of marine growth
- Default diagnostic
- Cables stabilization on sea bed

Numerical, Bench test, Model Tests

- Numerical modeling of the global configuration and cross section
- Experimental analysis of thermo-mechanical fatigue
- Forced and free dynamic response

In-situ monitoring

• Monitoring throughout the cable life cycle

With : Un Nantes / GeM, IREENA, MMS, IFSTTAR, Ifremer, CEA Tech, RTE, DCNS, EDF, EOLFI, Nexans, Ideol, ...













R&D P4 : Security, Safety, Marine operation





tdeol

Pre-Lay Methodology

> Anchors Positioning & Pre-stretching





Modelling of marine operations

→Operations improvement
→Embarked Real-time Calculation

FRYDOM project

- > Multibody dynamics
- > Cable dynamics
- > Unsteady / transient responses
- > Waves and wind loads
- > Water entry/impact
- > Controllers (crane, turbine, winch)
- > Dynamic positioning















- General overview of the challenges
- Targeting the cost reduction of MRE
 - From TRL 1 to TRL 8
- Attractive Research Platform for MRE
- Open to host other concepts or projects

