R&D collaborative projects for MRE and Offshore Wind, the national institute of reference: France Énergies Marines

N. Germain

EERA DeepWind 2018 conference – French Corner

18th January 2018, Trondheim, Norway

UNDERGOING FRENCH BOTTOM-FIXED OFFSHORE PROJECTS

Commercial offshore wind farms in France

Commissioning 2020-21

Jobs | **Market** | Future | Focus

Overview of the wind power market

Bottom-fixed offshore wind: 6 winning projects

Fécamp
Haliade 150
83 wind turbines – 498 MW
Favourable Environmental impact permit received, concession signed

Le Tréport
D 8-180
62 wind turbines – 496 MW
Application for a planning permit

Courseulles-sur-Mer
Haliade 150
75 wind turbines – 450 MW
Favourable Environmental impact permit received, concession signed

Saint-Brieuc
D 8-180
62 wind turbines – 496 MW
Favourable Environmental impact permit received, concession signed

Saint-Nazaire
Haliade 150
80 wind turbines – 480 MW
Favourable Environmental impact permit received, concession signed

Yeu-Noirmoutier
D 8-180
62 wind turbines – 496 MW
Application for a planning permit

2.9 GW
10 billion euros of investment

FOCUS ON FRENCH FLOATING OFFSHORE PILOT FARMS

INSTALLATION: 2021

INVESTMENT: ~300M€

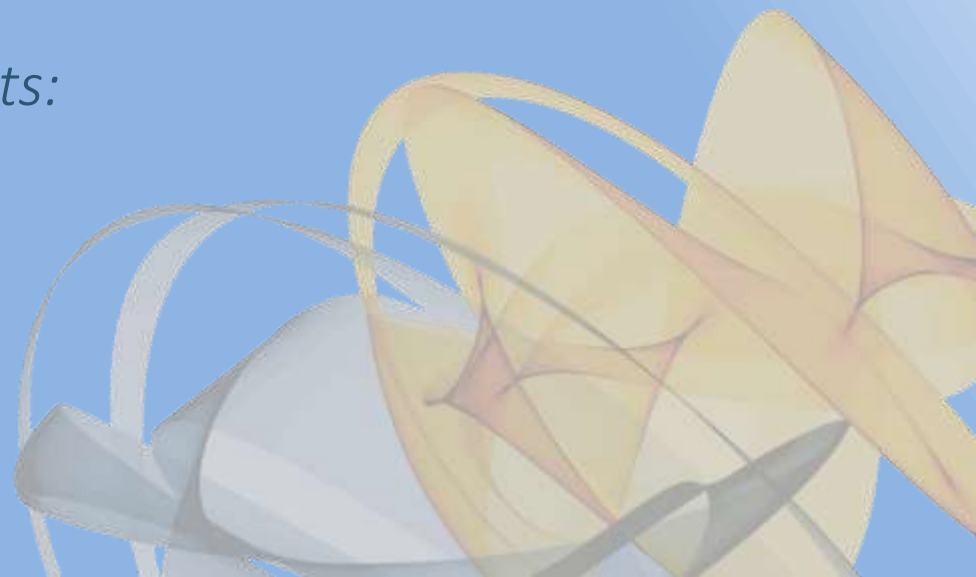
Feed-in tariff: 240€/MWh

France Energies Marines

Created in 2012, FEM is the National reference institute for Marine Renewable Energy (MRE) Research and Development.

FEM concentrates on providing:

- *Support for the French Marine Renewable Energy (MRE) sector,*
- *A high level of expertise in the field of MRE,*
- *Contributions to the realization of diverse MRE projects:*
  - *Offshore wind,*
  - *Tidal,*
  - *Wave,*
  - *Ocean thermal energy conversion (OTEC)*



France Energies Marines

Created in 2012, FEM is the National reference institute for Marine Renewable Energy (MRE) Research and Development.

FEM bases its actions on:

- *Public/private collaboration,*
- *Collaborative R&D projects bringing together actors from the MRE French and international ecosystems,*
- *Representative mandates in international organizations (IEA/OES, …)*

France Energies Marines is:

Key Facts

A team of 18 research scientists, engineers and admin staff

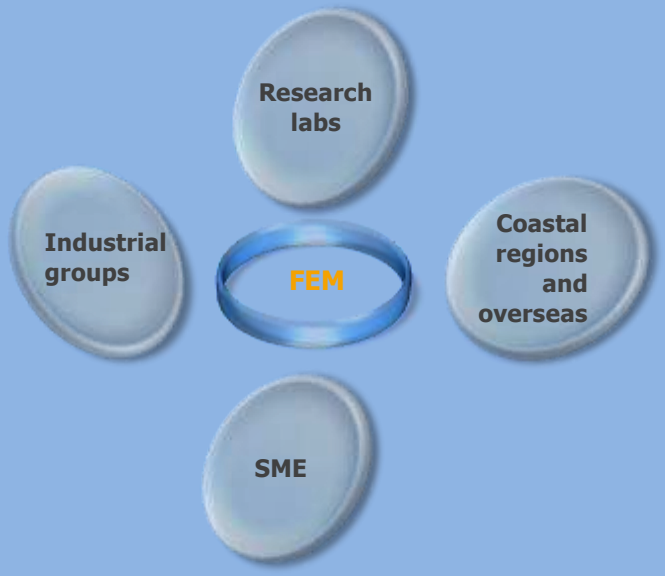
2.3 M€ annual budget for 2017

10 M€ co-financing budget for projects 2015-2017

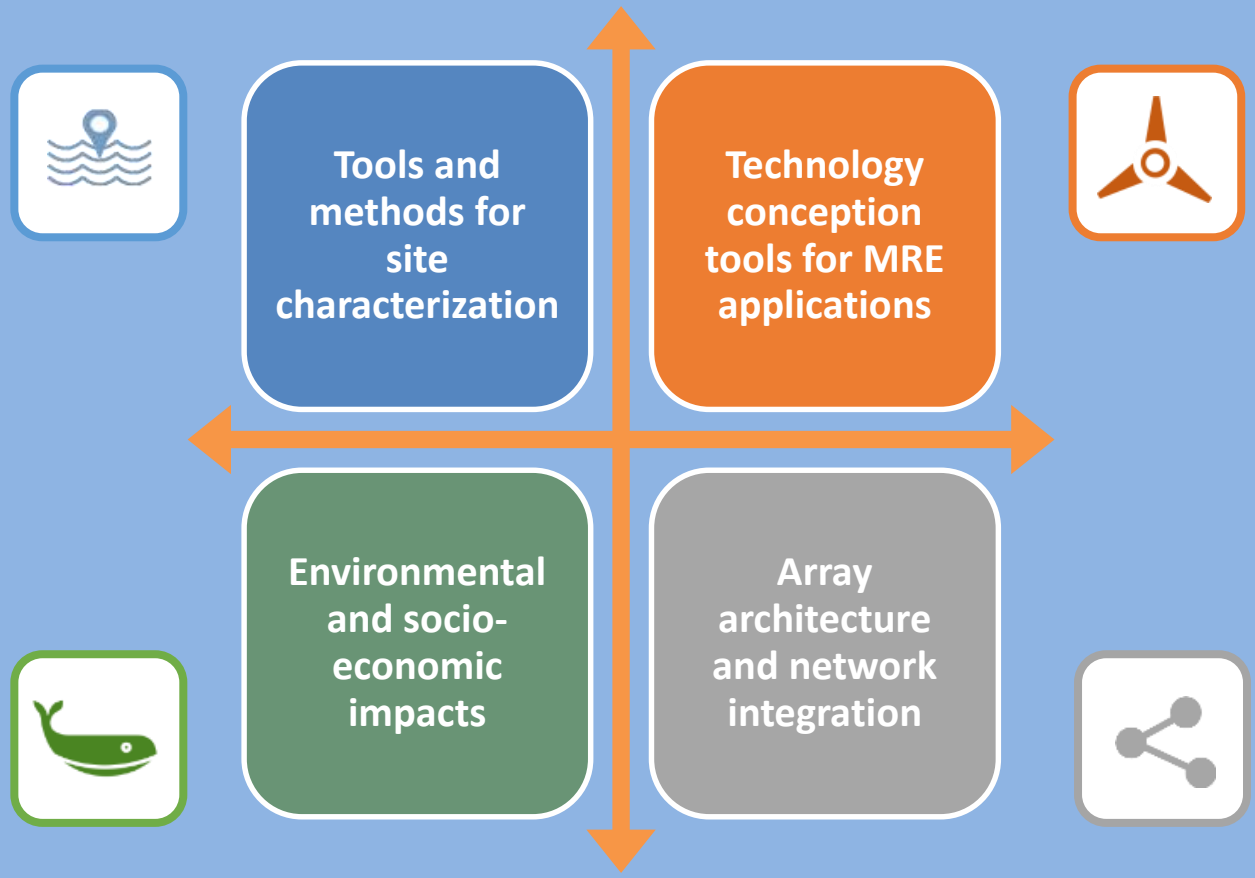
30+ projects completed or in progress

✓**32 members**
✓**23 collaborators**

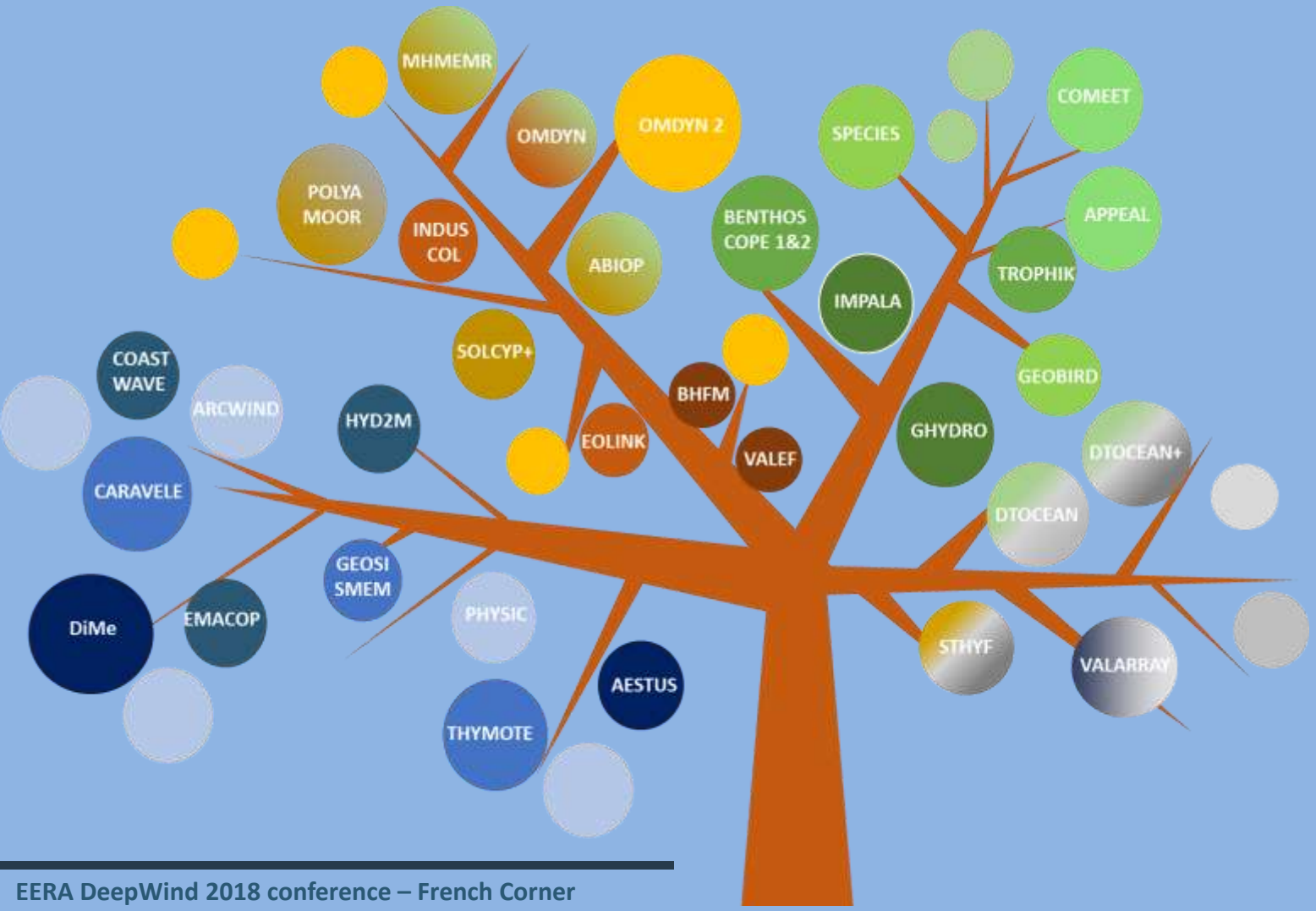
R&D collaborative projects

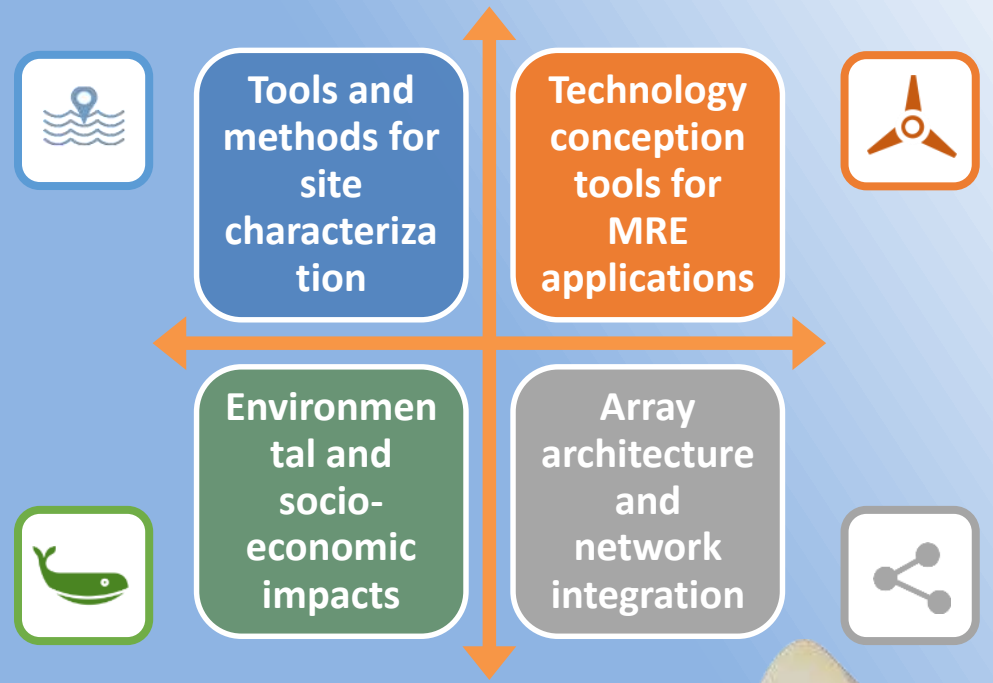


4 thematic programs



4 thematic programs

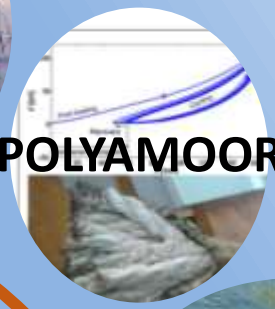


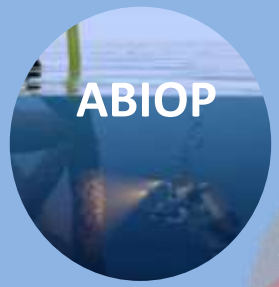


Offshore Wind projects @ FEM

15 Projects

15,6 M€
(5,9 M€ French subsidies)





DIME

Dimensioning and met ocean: modeling and observations of extreme sea states for MRE

DIME aims to improve the characterization of extreme sea states in order to reduce uncertainties in the calculation of induced loads. These uncertainties, in particular when taking into account breaking waves, affect the safety coefficients which determine the size of MRE systems.

By solving this challenge, DIME will allow engineers to dimension MRE converters and their peripherals as close to reality as possible.

Progress will be made in the modeling of spectral and deterministic waves for the parameterization of extreme sea state surges.

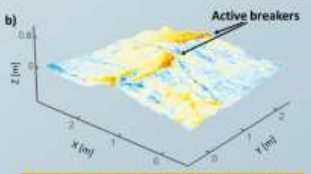
A large data set (PROTEVS) collected in coastal and near-shore zones during the winter of 2013-14, a period marked by a succession of storms remarkable for their intensity, will be exploited to complete the validation.

Deterministic simulations will be used to capture the non-linearity and precise kinematics (i.e. loads) of extreme sea states in the zone of breaking waves.

The role of interactions between wind and waves in storm and cyclonic conditions will be explored through the implementation of a model coupling the ocean and the atmosphere. These studies will be supplemented by wave flume trials.

The benefits of DIME will impact all MRE technologies.

Tiré de Clegnon (2009)



Source: Sutherland and Melville, 2013

Objectives :

- Improve the characterization of extreme (breaking) sea states for MRE systems,
- Contribute to standardizing the dimensioning of MRE systems.

This work received state support managed by the National Research Agency under the Investments for the Future program (ANR-10-IEED-0006-14)

contact@ite-fem.org
www.france-energies-marines.org

GEOBIRD

Development of an innovative geolocation tag for seabirds

Based on recognized experts and leading-edge technologies, the GEOBIRD project aims to develop and produce a miniaturized and communicating intelligent geolocation tag (bio-logger) integrating physiological and environmental data loggers that could be mobilized for the monitoring of sensitive, medium-sized avifauna.

The technological development resulting from the Geobird project will contribute to the improvement of knowledge concerning the spatial ecology of seabirds and their interactions with MRE projects (risk of aerial and underwater collision, avoidance, attraction, cumulative effects), allowing greater societal acceptance of these projects. Carried out in the deployment zones for fixed and floating wind farms, the test phase will allow for the collection of the first concrete results immediately exploitable within the French MRE sector.

Left: Maritime Seagull movements in the Mor Braz, north of the Saint-Nazaire wind farm (blue polygon) (Source : PERISCOPE – Bretagne Vivante) ; Right: Scopoli Puffin movements in the Marseille Islands, (Source : CEFE/CNRS, AAMP, Parc National des Calanques, CEN PACA)

Example of bio-loggers. Source : IPHC (CNRS/Unistra)

Objectives :

- Design and realization of a miniature geolocation tag for the monitoring of medium-sized avifauna (puffins, small laridae, diving species, etc.),
- Improve knowledge of avifauna in order to support environmental studies, authorizations and the MRE sector as a whole.

This work received state support managed by the National Research Agency under the Investments for the Future Program (ANR-10-IEED-0006-15)

contact@ite-fem.org
www.france-energies-marines.org

MHM-EMR

Mooring health monitoring

Anchoring systems used for floating wind turbines differ significantly from those used by the oil & gas sector due to high dynamics in shallow waters.

Currently proposed solutions to satisfy these new constraints employ new dispositions and materials whose long-term behavior is poorly known and remains non-qualified.

MHM-EMR proposes to define an in-service monitoring methodology in order to anticipate risks, optimize maintenance strategies and improve predictions of component longevity within anchor lines.

Objectives :

In service monitoring of MRE anchors to anticipate failures

- Identification of dimensioning parameters;
- Interpretation of measurements and updating of component longevity;
- Design and maintenance optimization through recommended components and procedures.

This work received state support managed by the National Research Agency under the Investments for the Future Program (ANR-10-IEED-0006-19)

contact@ifa-fem.org
www.france-energies-marines.org

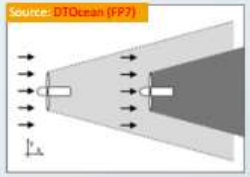
VALARRAY

Optimisation software for tidal and floating offshore turbine arrays: state of the art, comparison and new tools specification

The Levelized Cost of Energy (LCoE) is significantly influenced by the optimisation of the farm layout of Marine Renewable Energies.

Yet one can see that no commercial software is available for:

- ✓ Dedicated tidal or Floating Offshore Wind applications;
- ✓ Dealing with the simultaneous optimisation of several criteria such as:
  - the layout of energy converters (EC)
  - Control strategy of ECs
  - Bottom-surface connections and foundations
  - The inter-array electrical layout
  - ...

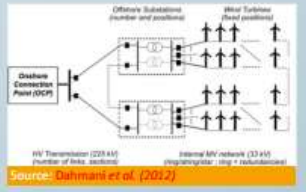


The actions are then to:

- ✓ Identify and classify the existing software solutions
- ✓ Gather and prioritize the stakeholders needs
- ✓ Test the available solutions and compare them rigorously through a benchmarking of the selected relevant codes
- ✓ Run a gap analysis and define the action plan for the selection and development of the tool set fulfilling the sector's needs

Resources implemented:

- ✓ 24 software identified up to now (commercial, open-source, academic, proprietary...)
- ✓ Involvement of end-users industrial partners
- ✓ Realistic test conditions
- ✓ Advisory-Board consulted for strategic orientation



Objectives :

- State of the art of optimisation software for MRE farms;
- Specification of stakeholders non-covered needs by available codes;
- Gap analysis and action plan;
- Feasibility study for the quick development of an appropriate tool suite.

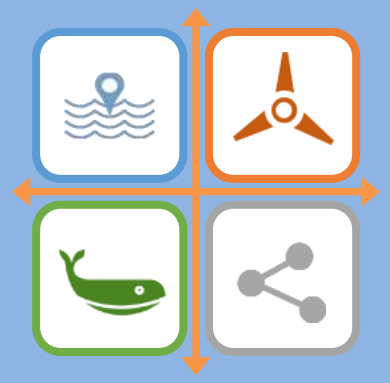
This work received support from France Energies Marine and State aid managed by the National Research Agency under the Investments for the Future program (ANR-10-IEED-XXXX-XX)

contact@ite-fem.org
www.france-energies-marines.org

EERA DeepWind 2018 conference – French Corner
18th January 2018, Trondheim, Norway

Projects for 2018

⇒ R&D consolidation of FEM activities
⇒ Beginning of collaborative project definition phase in February 2018
⇒ Open to and encouraging international collaboration



- We are moving to new premises (still in Brest)
- Bigger/newer place
- Better view

=> Come visit us!