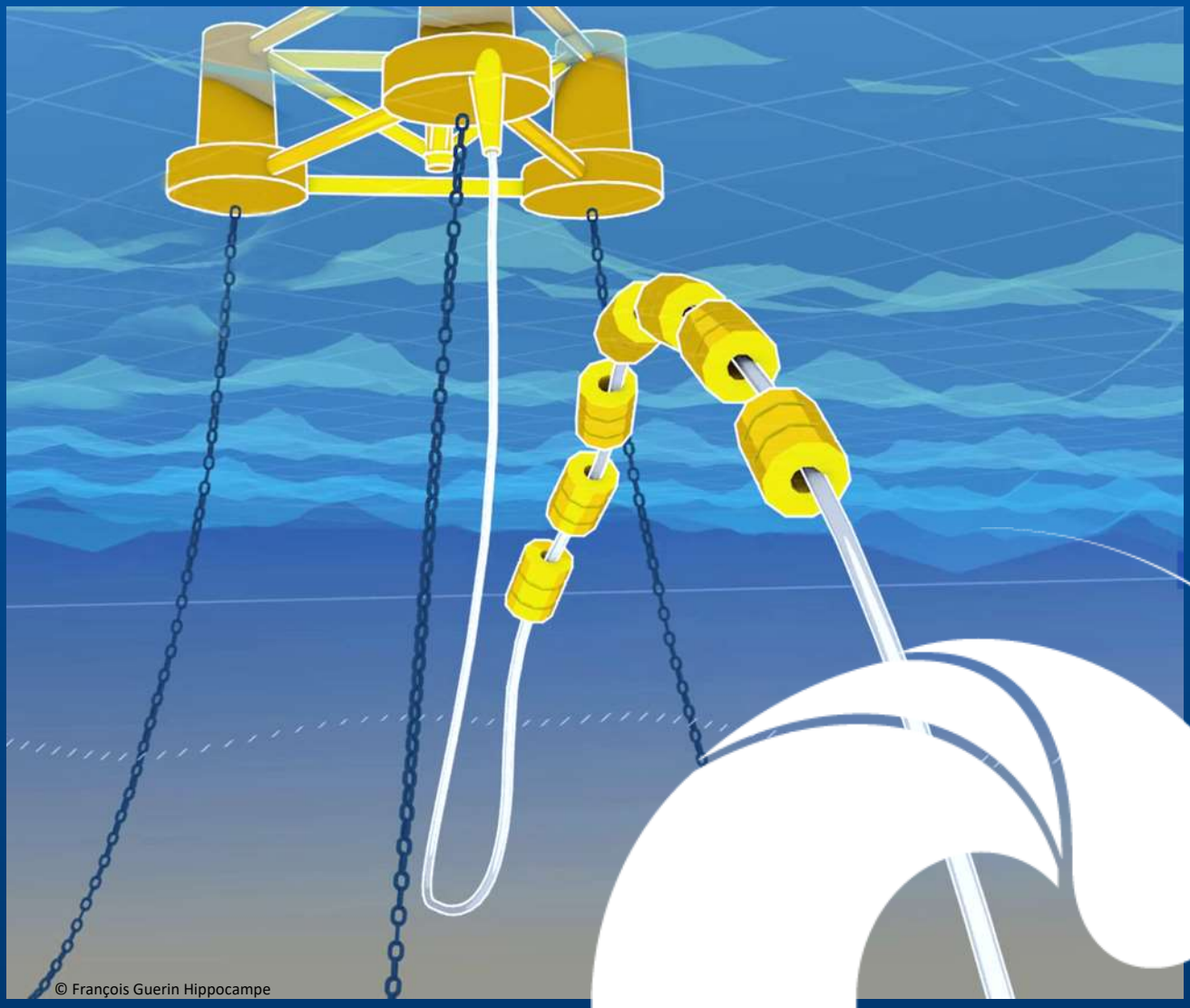
FRANCE ENERGIES MARINES

HT-20MW

Call for interest : Offshore CAble Shape Sensing **OCASS**



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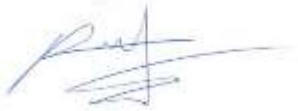
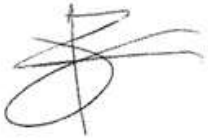
VISA			

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1 Context and objective of the call for interest

1.1 Context

France Energies Marines (FEM) is the French Institute for Energy Transition dedicated to marine renewable energies. Its mission: to define, set-up and apply a scientific and technical framework necessary to remove the obstacles facing this rapidly developing sector. With a multidisciplinary team of 85 employees and a model of public-private collaboration, the Institute has one purpose: R&D, whether collaborative or carried out as part of a service activity. France Energies Marines provides support for the various offshore renewable energy technologies by relying on four cross-disciplinary and complementary R&D programmes: site characterisation, design and monitoring of systems, environmental integration and farm optimisation.

FEM's strategically located headquarters in Plouzané (Brest area), France, along with our offices in Marseille, Nantes, and Le Havre, offer a unique advantage in building specialized knowledge on each maritime façade and cultivating close relationships with crucial stakeholders of the Offshore Renewable Energy value chain.

For more details: https://www.france-energies-marines.org/

Eolink was founded in 2016 by Marc Guyot, a former Renault engine engineer, who patented the Eolink floating wind turbine concept.
The Eolink floating wind turbine is the only wind turbine specifically designed for an offshore floating application. The concept incorporates all the characteristics of its marine environment, taking benefit of its advantages and minimizing its constraints. The Eolink design allows for larger turbines to be installed offshore, a competitive factor that helps reduce the cost of energy (LCoE).
Backed by a highly skilled team, Eolink focuses on experimental milestones to demonstrate its benefits. The company is based in Brest and relies on local know-how. The potential of the Brest region will allow it to industrialize its project while interacting with partners in Europe and around the world.

For more details: http://eolink.fr/

The HT-20MW project is developing and certifying a marine rotating connection enabling electricity to be moored and exported at a voltage of 66 kV. The hub's main application is for floating wind farms, but it can also be used for environmentally-friendly mooring of ships. The project includes the mechanical and electrical qualification of the electrical cable and mooring line sub-systems in the partner laboratories, as well as the design of a 20 MW floating wind turbine.

Pôle Mer Bretagne Atlantique is a competitiveness cluster dedicated to the blue economy. With a network of more than 440 players including large groups, SMEs, research and higher education centres, it conducts numerous events and influence actions: project labelling, participation in international fairs and missions or organization of thematic events. Thanks to these actions, Pôle Mer

Bretagne Atlantique contributes to the emergence of efficient and competitive solutions in all areas of maritime activity. Its main mission is then to support these projects in their development: advice, expertise, networking, financing, visibility and valorisation.

1.2 Objectives

The objective of the experimental campaign is to test the ability of monitoring technologies to measure the deformed shape of a dynamic subsea power cable, continuously in time and space (3D), from the floater. The ultimate objective is to be able to process (or count) curvature radius or stress peaks, to estimate remaining lifetime of the assets.

The first objective of this call for interest is for FEM and Eolink to better apprehend the possibilities of more or less mature shape monitoring technologies available on the market. The second objective of this call for interest is for the applicants to profit from the experimental campaign conducted by France Energies Marines within the HT20MW project led by Eolink and use the results for improving the TRL and visibility of their monitoring solutions.

1.3 Description of the experimental campaign

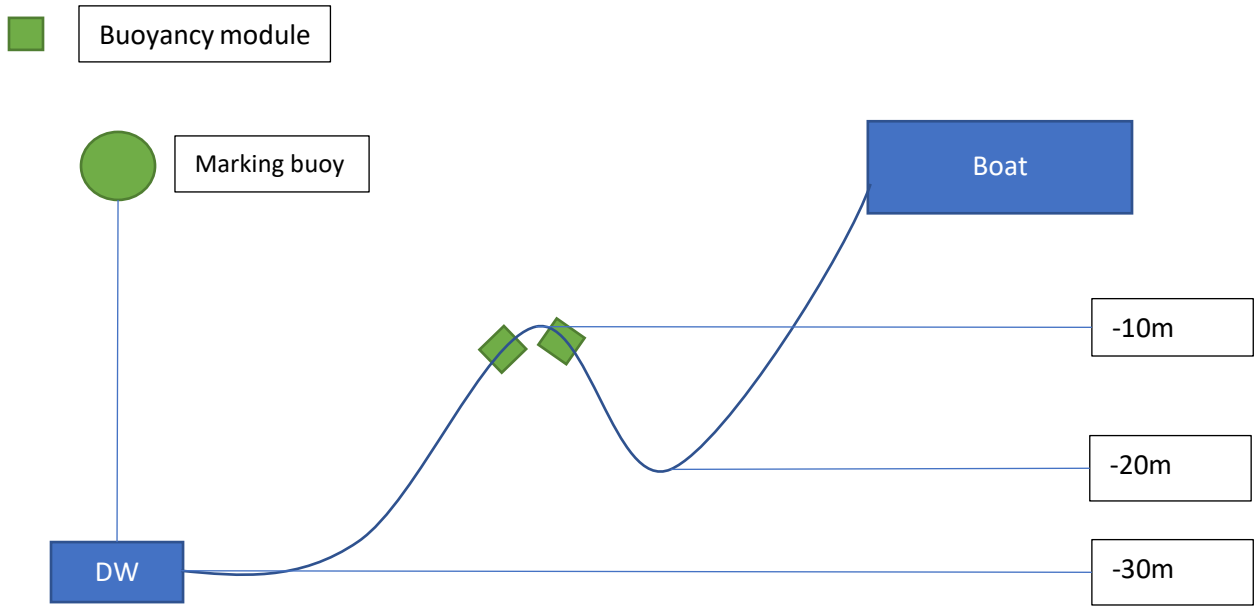

Figure 1: indicative deployment configuration of the cable in 30m depth

A service boat will be used to deploy a deadweight (DW) and a dynamic power cable between the deadweight and the boat's deck, in the nominal lazy-wave configuration schematized in Figure 1. The exact number of buoyancy modules (two indicated on Figure 1) is still to be confirmed, depending on their unit volume and the distribution of buoyancy targeted. The depths mentioned on Figure 1 are indicative. The targeted depth for the experimental campaign is between 20m and 30m; in the case of a 30m depth, horizontal distance between the deadweight and the hang-off is supposed to be around 50m. The power cable is a double-armoured 10kV dynamic design, outer diameter 6.8cm, length approximately 80m, featuring 18 embedded single-mode fibre optics in one eccentric bundle.

The cable will endure different types of loads: fatigue loads using the boat movements on the anchors due to the ambient waves, and extreme offsets simulated by moving the boat around. The deployment

will take place in the bay of Douarnenez, France. The time of deployment and exact location and depth, regarding exposure to swell, will be chosen according to weather forecasts, so that wave loadings are significant enough without exceeding the boat limit range and cable specifications. It is expected to happen between June 2024 at the earliest, and September 2024 at the latest. The targeted planning is solicitating the boat and equipment for four days: one day of installation and commissioning of the systems, two measurement days, one day for decommissioning and uninstallation. The typical size of the boat to be used is the TSM Penzer.

During the whole deployment period of time, FEM will collect data on boat movements (6 DOF) and cable shape, that will be confronted with internal numerical models to validate shape timeseries. Acquisition of pulling force is planned, subject to feasibility depending on cable integration on the deck. Acquisition of current profiles over the water column are planned throughout the measurement days. FEM data will be GPS-time-synchronized.

Common acquisition windows of less than one hour will be defined before the deployment, over which all the monitoring solutions shall be recording simultaneously. The number of mandatory measurement windows will be limited to 6 per day. These common measurement windows will be used for comparing the results from the different measurement technologies, to help understanding the signals recorded. Acquisition during the installation of the cable may be triggered for the monitoring technologies able to acquire during cable installation.

1.4 Loadings

The “fatigue” solicitations will be applied by wave-imposed movements and, as such, will depend on the meteorological conditions during the test period, that will be chosen at the upper limit of the operating conditions of the service boat. The typical amplitude of hang-off movements is targeted to be between 50cm and 150cm, at a frequency between 0.1Hz and 1Hz.
The “extreme” solicitations will be applied by moving the boat around the reference position giving the reference lazy-wave configuration, and eventually moving or adding or removing one or more buoyancy modules. To be noted that “extreme” records will happen at the same location as fatigue records, hence the contributions are likely to be superimposed.
Levels of loadings in terms of curvature are to be confirmed but will be of the order of magnitude of a few meters.

1.5 Role of FEM and limits of liability

FEM provides the service boat, installs the deadweight and the cable equipped with its buoyancy modules and mechanical terminations. FEM will cover up to one two-ways travel per selected entity and per day at sea, on a transfer boat, between the closest significant harbour (Douarnenez or Morgat) and the service boat, including equipment or luggage under 80kg in total but at the risk of the owner. Heavier equipment will have to be loaded on the service boat before leaving Brest harbour. FEM will require, but will not provide, safety equipment (at least safety shoes, helmet, and lifevest) for all individuals onboard the boat. FEM will not provide insurance for third-party damage induced by the candidates, nor will FEM provide insurance for equipment damages or losses to the candidates.
The cable installation procedure may be modified to include pauses, for the candidates to integrate sensors or wires under their own responsibility. FEM do not plan to use divers or ROVs during the

experimental campaign, but the selected candidates might have the right to use their own divers or ROVs, under agreement to be reached between FEM and the concerned candidate.

Once the cable is installed, FEM will provide access to the cable and its FOs without terminations or connectors, and to 220V power in a dry room or an on-deck container with enough space for the dataloggers, interrogators, storage devices of all selected technologies. No wi-fi connection will be available.

Once the experimental campaign is over, FEM will provide the selected candidates with the cable shape timeseries and all the data recorded by FEM during the mandatory measurement windows, at least, in the format decided by FEM (along with Python 3 reading routines if relevant). Transfer of additional data, recorded by FEM aside the mandatory measurement windows, towards the candidates will be possible upon specific agreement to be reached, with lower priority than processing and analysis of data from the mandatory measurement windows.

Once post-processing is over or advanced enough, FEM will write peer-reviewed article(s) and publish results or analysis in conferences including co-authors from the selected candidates.

1.6 Missions expected from the candidates

The candidates are expected to instrument the cable or its FOs, and to acquire data regarding cable shape or stresses. The candidates will be responsible for installing, running and uninstalling their systems. The solutions must be provided as a stand-alone configuration: the candidates shall provide all what is necessary for their own measurements and data storage (the procurement of all the hardware and software necessary for the measurements, processing, transfer and storage, along with the people and specific tools or materials necessary for installing running and uninstalling the systems).
In cases where remote acquisition is possible or acquisition is easy to launch, the presence of an operator during the mandatory measurement windows may be subject to discussions. A technology missing one measurement window will be withdrawn from the final comparisons and publications (except in the case of unexpected measurement issues).
It is expected that the candidates provide FEM with support on the analysis of their data and on correlations or comparisons with the shape and eventually strains data provided by FEM. The candidates shall provide FEM with the data (raw and/or post-processed, subject to one-by-one agreements, depending on the measurement technology) recorded during the mandatory measurement windows. It is expected that the candidates help FEM in understanding and using the data for conducting additional comparisons and correlations between the different monitoring solutions, accordingly with candidates' IP agreements negotiated between FEM and each candidate.
Measurements outside the mandatory measurement windows are free to use by the candidates under the conditions described in section 1.8, with support from FEM if possible, but with lower priority than mandatory measurement windows.

1.7 Benefits for the candidates

Benefits are multiple for the candidates:

- Access to unique testing facilities at sea in order to test and demonstrate technologies under several loads and stresses;

- Access to cable shape and boat movements timeseries to compare with;
- Support from FEM for understanding the records;
- Participation in the review or writing of a peer-reviewed article and conference papers;
- Promotion of the experimental campaign and results on FEM booths at the occasion of national or international events.

1.8 Exploitation of the results

The results will be exploitable as follows, and in accordance with the contractual frame of the HT20MW project:

- Selected candidates will have the right to use their own data as well as the data provided by FEM for internal or collaborative research and for public communication, without sharing FEM data, at the condition of mentioning France Energies Marines (and the HT20MW project led by Eolink). A typical sentence to be included in all publications will be provided to the selected candidates.
- Selected candidates will have the right to use their own data as well as the data provided by FEM in scientific publications at the condition of noticing FEM at least four weeks in advance, and including at least one co-author from FEM.
- FEM will have the right to use, without selling, the results for:
  - Internal R&D,
  - Collaborative R&D without transmission of the data,
  - External communication and scientific publications (FEM is specifically looking forward to joint scientific publications).

More specifically, FEM is wishing to publish at least one peer-reviewed article and to present partial results in conference talks or posters, eventually co-written with some selected candidates showing an interest for publications.

2 Rules for participation

2.1 Expected applications

All types of companies (Startups, SME, association, large enterprise, institute, university, etc.) providing a monitoring solution able to render cable shape, cable strain, or cable stresses, from all nationalities, can candidate. The measurements may be either distributed over the whole length of the submerged cable or over a part of the total length, or punctual (several points along the cable). The measurements can rely on acoustic, electro-magnetic, optical, electrical, mechanical principles, or any other principle providing information on cable shape, cable strain, or cable stresses. Examples of technologies may be, but are not limited to, MEMS-based technologies, FBG-based technologies, distributed sensing on fibre optics (DAS, DSS for instance), acoustic positioning, etc.
ROV-born technologies can candidate.

2.2 Eligibility criteria

Conditions for an application to be eligible to the call for interest:

- Candidates are required to demonstrate civil liability for the deployed material.
- Technology should already have been validated in laboratory, thus achieving TRL>4.
- Monitoring solutions need to feature GPS time synchronisation. Alternatively, the candidates are authorized to include in their application a draft procedure for time-synchronisation of their data with FEM GPS-time-synchronised data.

2.3 Application procedure

Applications can be submitted from the publication of the call for interest and until the 31st of March, 2024 (included). Applications are submitted through the procurement of the email address mentioned in section 5 with the application form completed and with all additional necessary document. Incomplete forms will be withdrawn. Good acceptance of an application submission will be notified via email to the responsible contact indicated in the application form.

Before sending a submission, a candidate can ask questions via email up to the submission deadline. The questions will be answered directly to the candidate in the following days and eventually included in the FAQ on the website of the call for interest.

If necessary, a Non-Disclosure Agreement may be signed between FEM and the candidates before submitting the application.

2.4 Selection criteria

The selection will be based on the following criteria:

- Shape and displacement monitoring will be prioritized over strain and stress monitoring.
- Compatibility with the other technologies deployed shall be guaranteed.
- Possibility of monitoring the cable installation and uninstallation phases will be appreciated.
- In the case of technologies using one or more embedded FOs, the number of FOs needed may be a criterion.
- In the case of technologies necessitating the installation of local sensors on the outer sheath or in/on the buoyancy modules, the added weight, drag, and inertia may be a criterion to avoid excessive singularities in the cable shape.
- Number of on-site operators needed.

A maximum of 6 candidates can be selected.

2.5 Selection process

The selection process features three steps:

1) Preselection on application submission forms
2) Candidates interview with a jury composed of members of FEM and Eolink, at least
3) Selection commission

2.6 Contractualization

A contract will be signed between FEM and the selected candidates to agree on the specific terms and conditions, on the basis of the conditions included in this document.

3 Expected results

3.1 Data to be provided by the candidates

The candidates will provide FEM with the processed data recorded during the mandatory measurement windows, and with figures showing the correlation between candidates' data and FEM data.
Any additional data, either recorded over a time period outside a mandatory measurement window, or processed further than planned will be welcome.
Data state (raw or processed) and data format will be defined on a case-by-case basis depending on the technologies and providers.

3.2 Final presentation and discussions on data comparisons

At least one Teams meeting will be organized between FEM and each candidate, for the candidates to present their results and for discussing the analysis.

3.3 Final report

Following the meeting(s), each candidate will provide FEM with a short final report including, for each dataset provided to FEM:

- Acquisition parameters relevant for FEM understanding of the datasets,
- Figures showing the correlations between candidates' data and FEM data,
- Written explanations on what can be derived from each figure,
- A short conclusion on the dataset.

Each final report shall also include a global conclusion on the whole measurement campaign and the relevancy of the protocols, and may include a return of experience on the test campaign (including for instance propositions of improvements for a hypothetic similar future campaign).

Explanations of the context or information on the test campaign are not required in these final reports.

4 Organization and schedule of the call for interest

13/02/2024 at 15h00: presentation of the call for interest (webinar), open to all (register using the following link: https://register.gotowebinar.com/register/431198109897074783).
31/03/2024: application deadline and candidates preselection.
Week 14, 2024: announcement of the candidates selected for an interview.
Week 16 to 18, 2024: candidates interview and announcement of the final candidate selection.
Week 20, 2024: deadline for individual contracts signature.
Between weeks 25 and 39, 2024: experimental campaign.

5 Contacts

All questions and applications can be sent to ocass_project@france-energies-marines.org.

6 Rules for access and sharing, confidentiality, intellectual property

6.1 Financial rules

FEM will provide the candidates with what is described in section 1.5 and to the limits described herein.

All the remaining fees remains the responsibility of the candidates: it includes, but is not limited to, displacement fees, salaries, transport fees, accommodation fees, meals.

No additional compensation or indemnity should be anticipated from FEM.

6.2 Intellectual property

The only asset concerned with IP are measurements and results: IP of measurements and results obtained by the candidates stays with the candidates, with right of use from France Energies Marines, for the applications described in section 1.8

6.3 Confidentiality

Brands and company names of a candidate may be hidden on publications if required by this candidate.
No data will be exchanged between candidates, except under specific agreement.
Final presentations and final reports will be confidential between FEM and each candidate, but some figures may be included in FEM reports or presentations to be shared within HT20MW consortium and for all the objectives described in section 1.8.