# INTERNSHIP
# WIND TURBINE FARM ARCHITECTURE OPTIMISATION TOOL



**PRINCIPIA**

## INTRODUCTION:

For several years, PRINCIPIA is developing DEEPLINES WIND™ for design of floating wind turbine considering coupling between hydrodynamic and aerodynamic effects.

This is indeed a major progress for the design of Floating Offshore Wind Turbines (FOWT).

With FOW farm soon to reach a pre-commercial status, optimization of existing floating substructures becomes crucial in order to achieve a high level of industrialization and so, a low-cost mass-production of these items. Although floating wind has known a rapid increase of its technology and manufacturing readiness level, the best arrangement of wind turbines is still a work in progress as large FOWT still do not exist.

The wake effect, - the fact one Wind turbine ('WT') reduces the wind speed for the one behind - implies that compact architecture is not optimal. On the other hand, the foot print on a whole wind farm is limited which imposes to draw compromises in terms of wake effect/number of WT/production in a given space.



The objective of the internship is to implement a code enabling parametric study to optimise the number and placement of turbines depending on several criteria (could be annual energy production (AEP), cost of energy (COE) or annual profit (AP)).

## SCOPE OF WORK:

The scope of work includes the 5 following tasks:

1. Criteria implementation (definition available)
2. Wake effect implementation (Gaussian wake model will be used as a base case- definition available)
3. Design variable parameterizations (grid, boundary conditions etc)
4. Implementation of Optimization algorithms to maximize AEP, COE or Annual profit: (some algorithms are already envisaged but we are open other ones)
5. Implementation of nice looking visual outputs (wake effect in the wind farm depending on wind direction and speed, AEP dep on the number of turbines ….)

The first objective is to implement one wake effect law and one optimisation algorithm.
The second is to consider other wake effect laws and optimisation algorithms.
The third is to perform comparative study of results variation for the various wake effect law, optimisation algorithm.

**DELIVERABLES:**

Technical report including the description of the code (criteria, grid, optimisation algorithm, wake model …) and a comparison with a case from literature.

Code shall be flexible enough

- To choose between the several optimisation algorithms
- To enable the use of wind scatter diagrams (wind speed/direction occurrence)
- To choose between the several wake models
- To be open to the addition of other parameters in COE and AP laws (floaters orientation, power cable length reduction, mooring point mutualisation …)

**GENERAL**:

✓ Duration: 6 months

✓ Start date: Early 2022

✓ Location: PRINCIPIA offices in La Ciotat (Bouches du Rhône).

✓ To apply : job@principia.fr