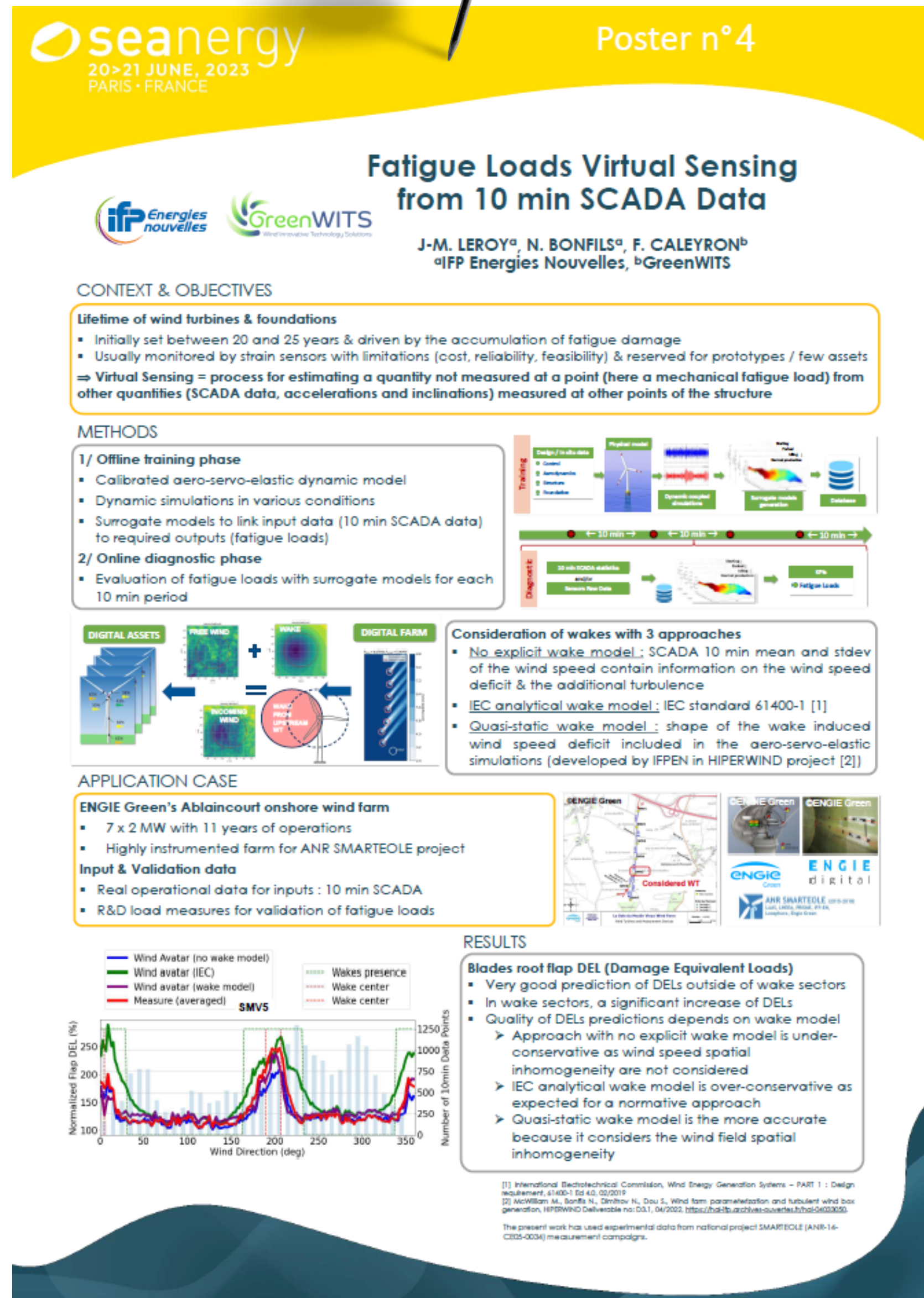


ILLUSTRATE ...WITHIN REASON

Of course, it's always a good idea to include graphics and photos, but be careful not to lose the reader's attention (for example, avoid formulas)



seanergy 20-21 JUNE, 2023 PARIS - FRANCE **Poster n°4**

Fatigue Loads Virtual Sensing from 10 min SCADA Data
J.-M. LEROY¹, N. BONFILS², F. CALEYRON³
¹IFP Energies Nouvelles, ²GreenWITS

CONTEXT & OBJECTIVES

Life-time of wind turbines & foundations

- Initially set between 20 and 25 years & driven by the accumulation of fatigue damage
- Usually monitored by strain sensors with limitations (cost, reliability, feasibility) & reserved for prototypes / few assets

⇒ **Virtual Sensing** = process for estimating a quantity not measured at a point (here a mechanical fatigue load) from other quantities (SCADA data, accelerations and inclinations) measured at other points of the structure

METHODS

1/ **Offline training phase**

- Calibrated aero-servo-elastic dynamic model
- Dynamic simulations in various conditions
- Surrogate models to link input data (10 min SCADA data) to required outputs (fatigue loads)

2/ **Online diagnostic phase**

- Evaluation of fatigue loads with surrogate models for each 10 min period

APPLICATION CASE

ENGIE Green's Abincoast onshore wind farm

- 7 x 2 MW with 11 years of operations
- Highly instrumented farm for ANR SMARTOLEO project
- Real operational data for inputs: 10 min SCADA
- R&D load measures for validation of fatigue loads

RESULTS

Blades root flap DEL (Damage Equivalent Loads)

- Very good prediction of DELs outside of wake sectors
- In wake sector, a significant increase of DEL
- Quality of DEL predictions depends on wake model

STRUCTURE

For example, try including:

- > Introduction
- > Method
- > Result box
- > Conclusion

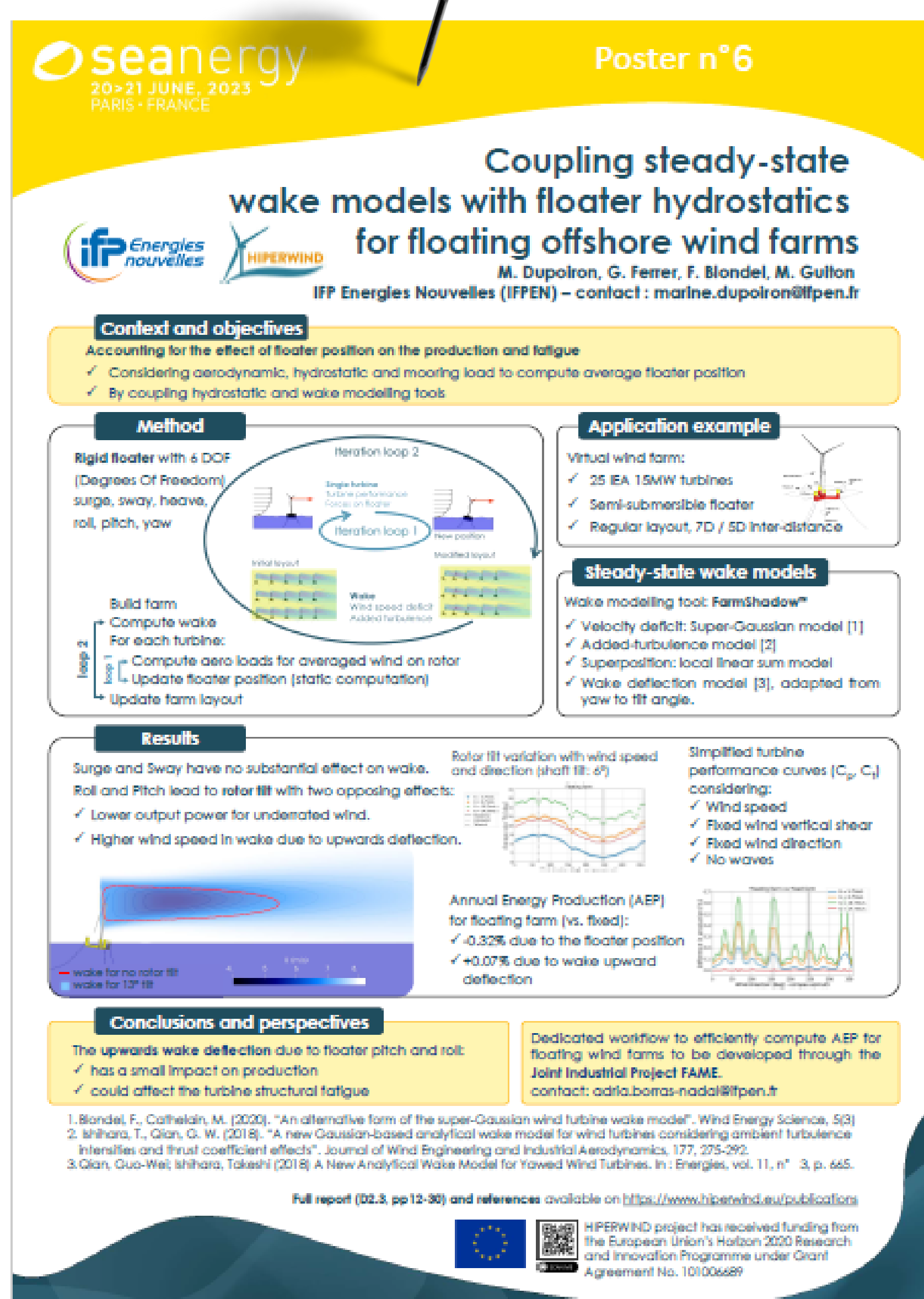
EASY TO READ

Your poster must be read from a distance of one meter. Our guideline:

- > Headings : Poppins semibold 100
- > Intermediate headings : poppins Medium 50
- > Texts poppins medium 30

TAKE A STEP BACK

Put yourself in the shoes of people who have no scientific knowledge, or even no knowledge of the industry.



seanergy 20-21 JUNE, 2023 PARIS - FRANCE **Poster n°6**

Coupling steady-state wake models with floater hydrostatics for floating offshore wind farms
M. Dupolton, G. Ferrer, F. Blondel, M. Gullon
IFP Energies Nouvelles (IFPEN) - contact : marine.dupolton@ifpen.fr

Context and objectives

Accounting for the effect of floater position on the production and fatigue

- Considering aerodynamic, hydrostatic and mooring load to compute average floater position
- By coupling hydrostatic and wake modelling tools

Method

Rigid floater with a DCF (Degrees Of Freedom) surge, sway, heave, roll, pitch, yaw

Build farm

- Compute wake for each turbine
- Compute zero loads for averaged wind on rotor
- Update floater position (static computation)
- Update farm layout

Application example

Virtual wind farm:

- 25 IEA 15MW turbines
- Semi-submersible floater
- Regular layout, 7D / 5D inter-distance

Steady-state wake models

Wake modelling tool: FarmShadow*

- Velocity deficit: Super-Gaussian model [1]
- Added-turbulence model [2]
- Superposition: local linear sum model
- Wake deflection model [3], adapted from yaw to tilt angle.

Results

Surge and sway have no substantial effect on wake.

Roll and pitch lead to rotor tilt with two opposing effects:

- Lower output power for undertilted wind.
- Higher wind power in wake due to upwards deflection.

Rotor tilt variation with wind speed and direction (shaft tilt: θ)

Simplified turbine performance curves (C_p , C_t) considering:

- Wind speed
- Rotor wind vertical shear
- Rotor wind direction
- No waves

Annual Energy Production (AEP) for floating farm (vs. fixed):

- 0.32% due to the floater position
- +0.07% due to wake upward deflection

Conclusions and perspectives

The upwards wake deflection due to floater pitch and roll:

- has a small impact on production
- could affect the turbine structural fatigue

Dedicated workflow to efficiently compute AEP for floating wind farms to be developed through the Joint Industrial Project FAME.
contact: oadja.bomas-nadal@ifpen.fr

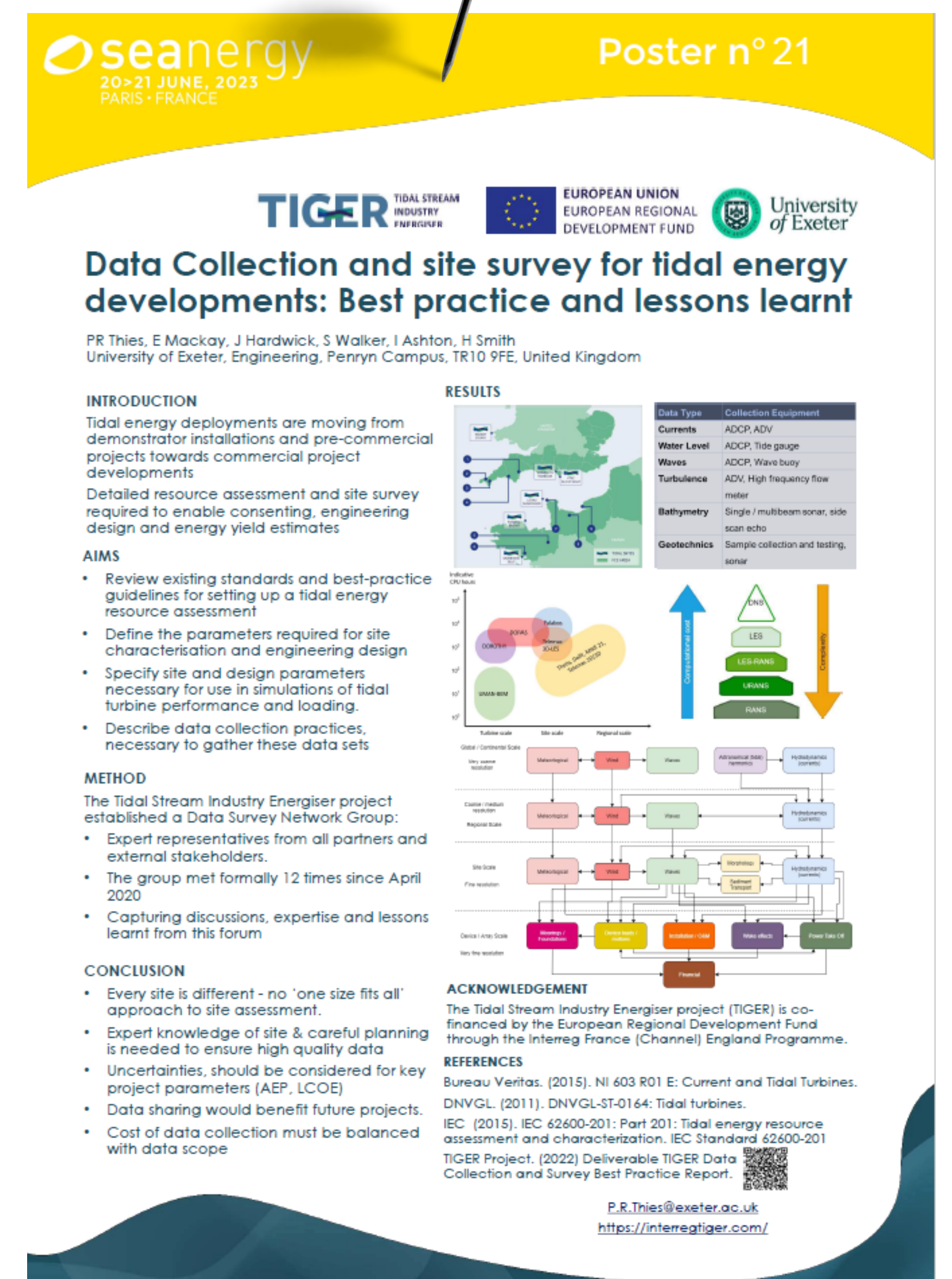
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Full report (20.33 pp 12-30) and references available on <https://www.hifpifpen.eu/publications>

IFPEN project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 10100689

KEEP IT BRIEF

The poster should give a comprehensive overview of your research, so don't hesitate to include a QR code for a more complete document (to a website, an article, etc)



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TIGER TIDAL STREAM INDUSTRY ENERGY PARTNERSHIP

Data Collection and site survey for tidal energy developments: Best practice and lessons learnt
P.R. Tries, E. Mackay, J. Hardwick, S. Walker, J. Ashton, H. Smith
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INTRODUCTION

Tidal energy deployments are moving from demonstrator installations and pre-commercial projects towards commercial project developments

Detailed resource assessment and site survey required to enable consenting, engineering design and energy yield estimates

AIMS

- Review existing standards and best-practice guidelines for setting up a tidal energy resource assessment
- Define the parameters required for site characterisation and engineering design
- Specify site and design parameters necessary for use in simulations of tidal turbine performance and loading
- Describe data collection practices necessary to gather these data sets

METHOD

The Tidal Stream Industry Energier project established a Data Survey Network Group:

- Expert representatives from all partners and external stakeholders
- The group met formally 12 times since April 2020
- Capturing discussions, expertise and lessons learnt from this forum

CONCLUSION

- Every site is different - no 'one size fits all' approach to site assessment
- Expert knowledge of site & careful planning is needed to ensure high quality data
- Uncertainties should be considered for key project parameters (AEP, LCOE)
- Data sharing would benefit future projects
- Cost of data collection must be balanced with data scope

ACKNOWLEDGEMENT

The Tidal Stream Industry Energier project (TIGER) is co-financed by the European Regional Development Fund through the Interreg France (Channel) England Programme.

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