

PhD position at IFP Energies nouvelles (IFPEN)
in *Mathematics or Computer Science and Information Sciences*

AI-Powered Wind Field Modeling for Next-Generation Wind Farm Optimization

Wind farms are essential to the energy transition, but their optimization remains limited by prediction models that use simplified representations of wind, ignoring the complexity of atmospheric conditions. **The result:** inaccurate predictions of energy production and turbine lifespan, hindering optimization and driving up costs.

The objective: to create a fast and accurate digital twin of wind fields at wind farm scale. You will develop generative models (probabilistic diffusion, autoencoders, transformers) capable of reproducing in a matter of seconds what high-fidelity simulations (Mésos-NH) compute in several hours.

The challenge: encoding the complex physics of turbulent flows into deep learning architectures while preserving essential spatio-temporal properties. You will work with data from Mésos-NH (CNRS/Météo-France) to train and validate your approaches.

The impact: faster feasibility studies, optimized turbine placement, and improved predictive maintenance. What you will gain: a rare profile at the physics/AI interface, and transferable skills well beyond the energy sector.

Your supervisors: Prof. Taraneh Sayadi (Cnam, M2N), expert in Scientific Machine Learning and model reduction for turbulent flows. Dr. Emeline Noël (IFPEN), specialist in boundary layer/wake interactions and Mésos-NH contributor. Dr. Guillaume Enchéry (co-supervisor), expert in model reduction for PDEs.

Keywords : Generative artificial intelligence (AI), diffusion models, autoencoders, transformers, dimensionality reduction, temporal dynamics, wind energy

Academic supervisor	Prof. Taraneh SAYADI, Cnam (M2N), https://orcid.org/0000-0001-9689-4528
Doctoral School	ED432 Sciences des métiers de l'Ingénieur, Cnam
IFPEN supervisor	Dr. Emeline Noël, emeline.noel@ifpen.fr , https://orcid.org/0000-0003-2429-7737
PhD location	IFPEN, Rueil-Malmaison, France
Duration and start date	IFPEN 3-year PhD fellowship, starting November 2026
Required skills	Applied mathematics (PDEs, modelling), Machine Learning (PyTorch preferred), multidisciplinary collaboration
Academic requirements	MSc in Mathematics and/or Computer Science, or equivalent engineering degree
Language requirements	English level B2 (CEFR)

To apply, please send your cover letter and CV to Dr. Emeline Noël.

About IFP Energies nouvelles

IFP Energies nouvelles is a public research, innovation and training organization whose mission is to develop high-performance, cost-effective, clean and sustainable technologies in the fields of energy, transport and the environment. For more information, please visit [our website](#).

IFPEN provides its PhD students with a stimulating research environment and high-performance computing resources. In addition to a competitive salary and social benefits package, IFPEN offers all doctoral candidates the opportunity to participate in dedicated seminars and training programs.