



COLLABORATIVE FUNDAMENTAL RESEARCH PROJECTS

IFPEN is actively involved in **numerous fundamental research projects with academic and industrial players**. These projects, launched within the context of calls for projects from a variety of sources — the French National Research Agency (ANR), Horizon 2020, the Auvergne-Rhône-Alpes region, among many others — benefit from national and European state support.



EXAMPLES OF PROJECTS BENEFITING FROM ANR FUNDING

3 new ANR projects selected in 2019

Muscats project

The Muscats (MUlti-Scale modeling of fluidized/ebullated bed reaCtors involving anisotropic parTicleS) project was launched in October 2019 for a period of 4 years: it concerns **scientific challenge No.6** and deals with “Transport in fluid/particle turbulent flows”. IFPEN joined forces with the Toulouse Institute of Fluid Mechanics (IMFT) and the Chemical Engineering Laboratory (LGC) to pool the fluid mechanics and chemical engineering expertise required to achieve a common objective: **develop innovative CFD (Computational Fluid Dynamics) models capable of predicting the multi-scale reactions occurring in liquid-solid fluidized beds with anisotropic particles.**

The focus of little research to date, unlike gas-solid fluidized beds with spherical particles, liquid-solid fluidized beds are nevertheless **widely used in a variety of industrial processes dedicated to oil and biomass exploitation as well as water treatment**. By gaining a better understanding of them they can be optimized for the benefit of the energy transition.

Momenta Project

Launched in January 2020 for a period of 4 years, the Momenta (farM rOtor ModEl accouNting aTmospheric wAke turbulence) project brings together several partners: the French Aerology Laboratory ([LA](#) – CNRS, Paul Sabatier – Toulouse III University), the Hydrodynamics, Energy and Atmospheric Environment Research Laboratory ([LHEEA](#) – Centrale Nantes engineering school, CNRS), the Multidisciplinary Mechanical Systems Engineering Research Laboratory (PRISME - INSA-Centre Val de Loire, Orléans University) and [VALEMO](#), a company specializing in the management, monitoring and maintenance of renewable energy facilities.

The aim of this project is **to study the impact of atmospheric turbulence and wake turbulence on the structural loads of wind turbines**. Lidar sensors and an LA drone will take wind measurements at a wind farm operated by VALEMO. Experimental work will also be carried out on a model. The results obtained will serve as a basis for **improving aerodynamic wind turbine and wind turbine wake models**, as used, for example, in the DeepLinesWind™ software.

In the long term, the project is also aimed at **optimizing the configuration of wind farms arranged in closely spaced rows**, in terms of energy efficiency and load reduction.

Upgeo Project

With 55 geothermal doublets* supplying the heating networks in the Paris basin in 2019, **the Ile-de-France region has the highest density of geothermal operations anywhere in the world**. Rapidly increasing this production via the creation of some forty doublets by 2030 requires the positioning of future wells to be optimized in order **to guarantee the resource over the long term**. The 4-year "UPscaling and heat simulations for improving the efficiency of deep GEOthermal energy" project, launched in January 2020, is aimed at gaining a better understanding of the Dogger and lower Cretaceous reservoirs of the Paris basin – their heterogeneity in terms of sedimentary geometries, porosity/permeability, connectivity – and **optimizing the development of new production zones thanks to numerical flow and heat flow simulations**.

Bringing together IFPEN and 7 academic and industrial partners**, Upgeo pools the expertise of geologists and mathematicians in order to scale up from laboratory permeability measurement to reservoir modeling, incorporating the understanding of sedimentary heterogeneity at various scales. The expected results will take **the form of a map of risks for the development of future doublets and advice regarding optimized well positioning**.

*Geothermal doublet: a system made up of two wells, one dedicated to the production of the geothermal fluid, and the other to the reinjection of the fluid into the aquifer once the heat has been extracted, enabling the sustainable management of the resource as well as the maintenance of well

pressure.

**GPC Instrumentation Process, Bureau de Recherches Géologiques et Minières (French Geological Survey), Géoresources & Environnement (Georesources & Environment), French Climate and Environmental Sciences Laboratory, Camille Jourdan Institute, Orsay Mathematics Laboratory and GEOPS

In 2020, **4 projects** have been selected: ALEKCIA and SAMOURAI ([challenge #7](#)), OFELIE ([challenge #6](#)), MICRO-Q-LI ([challenge #1](#)).



EXAMPLES OF PROJECTS BENEFITING FROM REGIONAL

FUNDING

The **MoSHy project**, launched in July 2018 and selected by the Auvergne-Rhône-Alpes region within the context of the 2018 Pack Ambition Recherche **call for projects**, is aimed at developing methodologies for defining an economical and efficient electrocatalyst for the production of hydrogen from water, by combining experimentation and molecular modeling. The partners are IFPEN, the Grenoble LEPMI (electrochemistry and physical chemistry of materials and interfaces) laboratory and the [LC-ENSL \(chemistry\) laboratory](#) (project leader).

IFPEN will contribute **its recognized expertise in the development of sulfur-based catalysts** (MoS₂), widely used in the field of hydrotreatment, and provide **support to electrochemistry and thermodynamics and molecular modeling teams**. The ultimate aim is to establish and validate a methodology for selecting and defining electrocatalysts. The success of this consortium will demonstrate the capacity of the local fabric to produce innovative solutions to industrial problems.



EXAMPLES OF PROJECTS BENEFITING FROM EUROPEAN FUNDING

For the purposes of its fundamental research, IFPEN participates in numerous European projects and networks (ETP4HPC, EERA AMPEA, Flagship SUNRISE, etc.).

Edem Project

Launched in September 2019 for a period of four years, the fundamental research project named **EDEM** (Experimentally validated DNS and LES approaches for fuel injection, mixing and combustion of dual-fuel engines) falls within the framework of the ITN-MSCA* Horizon 2020 program. Alongside **ten partners** and with the support of eight other research laboratories and industrial players, IFPEN is responsible for two thesis topics within this project, the aim of which is **to gain a better understanding of the way dual-fuel engines**

(diesel and another fuel with a lower carbon/hydrogen ratio such as natural gas) operate and model their combustion.

The objective of ITN projects is to structure networks, particularly in Europe, **to train new generations of researchers**, developing their creative, entrepreneurial and innovative potential within an international context. PhD students thus benefit from a mobility program, specific training and research seminars tailored to the project.

* Innovative Training Networks-Marie Skłodowska-Curie actions for the European financing of PhD student networks

>> Find out more about [the Edem project](#)

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