



**IMT Atlantique**  
Bretagne-Pays de la Loire  
École Mines-Télécom



Thesis offer:

## Energy transition of ports: energetic systems optimisation in a multi-actor context

### Hosting organisations

This thesis is a CIFRE one, that is to say a thesis co-supervised by a private company and a research institution. Here, the former is Akajoule, an engineering firm and the latter is IMT Atlantique, an engineering school. The thesis will belong to the ValaDoE (added value to energy data) chair and within the doctoral school SPIN.

#### Akajoule

Akajoule is an independent engineering and consulting firm, whose expertise lie in energy efficiency and renewable energies.

Our mission statement: accelerate the energy transition through innovation and expertise.

Founded in 2010 in Saint-Nazaire, Akajoule has 60 employees and is also present in Toulouse and Valence-TGV to accompany as close as possible companies and territorial collectivities. Our independence and our approach of consulting favor trust and proximity relationships with our customers.

Our 8 expertise (companies and industrials, building renovation, PV energy, energy planning for territories, transport and alternative fuels, digital and renewable heat, sustainability) guarantee a global vision of projects, from preliminary design to implementation.

Recognized partner of BPI (french public bank of investment) and of ADEME (french agency for environment and energy management) and member of the ValaDoE chair, Akajoule is committed to accelerate energy transition, especially through innovation. R&D is core of Akajoule DNA, as 7 R&D collaborative projects are already done.

Our platform Datajoule is an innovative digital tool gathers, analyze and valorize data on energy and climate (open and close data) to support decision-making and accelerate transitions.

We also acquired a renowned expertise in specific fields like collective self-consumption or port decarbonation.

With the MERS R&D project, we realized, in 2024-2025, an exhaustive energy study on the 3 ports of Les Sables d'Olonne (fishing, trade, yacht), in order to define the best mid-term energy trajectory. Another study is ongoing on energy transition and flexibility on the ports of Lorient Agglomération. In 2023, we also performed a mission of project management assistance for the design of a strategy for energy transition of the grand port maritime de la Guadeloupe.

Member of the competitiveness pole of Pôle Mer Bretagne Atlantique, Akajoule keeps itself up to date on port topics and participate to multiple events about marine-related decarbonation.

#### IMT Atlantique

IMT Atlantique, internationally recognised for the quality of its research, is a leading general engineering school under the aegis of the Ministry of Industry and Digital Technology, ranked in the three main international rankings (THE, SHANGHAI, QS).

Located on three campuses, Brest, Nantes and Rennes, IMT Atlantique aims to combine digital technology and energy to transform society and industry through training, research and innovation. It aims to be the leading French higher education and research institution in this field on an international scale. With 290 researchers and permanent lecturers, 1000 publications and 18 M€ of contracts, it supervises 2300 students each year and its training courses are based on cutting-edge research carried out within 6 joint research units: GEPEA, IRISA, LATIM, LABSTICC,

LS2N and SUBATECH.

The proposed thesis is part of the research activities of the team OSE (optimisation of energy systems) of the laboratory GEPEA (chemical engineering for environment and agri-food) and the department DSEE (department of energetic systems and environment).

## Context

In a sectorial vision of energy transition, the potential for economic, energetic or environmental efficiency gains in the maritime sector is well identified. Beyond the topic of decarbonation of the ships (out of the scope of the proposed thesis), decarbonation of port activities is an important issue by itself.

Commercial maritime traffic often implies that port areas are complex territories regarding energy aspects, where the nature of the various companies present is adapted for deploying approaches based on Industrial and Territorial Ecology (ITE). In particular, it is expected that a symbiosis based on energy exchanges should emerge through a better integration of industrial sites in port areas, as soon as the collective efficiency of the territory is considered in addition to the efficiency of each site alone.

Scientific literature proposes methods and models enabling this two-scale analysis. However, they are limited to a purely technical prism, notwithstanding that port complexity comes also from the diversity of actors involved, each with its own issues, priorities and decision processes. It is then necessary to complete those existing works with methodology and tools handling this specificity, in order to fuel the processes of collective reflexion and decision between actors of port areas.

## Thesis topic

The proposed thesis is focused on determining the actions to be taken by port managers to succeed in their energy transition, especially through the identification of the best investments in energetic systems (systems dedicated to production, conversion or storage of energy). Those systems could belong to individual actors but also be shared among actors of port areas. Well-known optimisation technics will be used for this. Moreover, models already established in the scientific literature will be used, especially those in relation with energetic systems relevant for port areas (by adapting them when needed).

The novelty of the thesis lie in the multi-actor environment of port territories. As a matter of fact, as each company present in the port is fully autonomous in its investment choices (but controlled by the indirect governance of port manager), a "centralised" optimisation (one not considering the specific expectations of each actor) could result in irrelevant propositions for port manager, or at least to subpar performance. Taking into account these specificities (from exchanges with actors, proper knowledge of AkaJoule, literature review, ...) will be necessary and will guide to the methodology (beyond optimisation) relevant to accompany decision processes. The way of integrating those aspects, as well as the specifics of the optimisation technics, will be determined during the beginning of the thesis and will probably consist in an *ad hoc* combination of technics already present in other fields.

Last, like all long term planification works, strong hypothesis (climatic, economic, legal, ...) will be required to set up the optimisation problem and they will induce a strong uncertainty on the produced results. Sensibility analyses will be conducted to overcome this problem: the variations in results in function of the hypotheses made will be explored, still in the objective to formulate recommendations to port stakeholders.

## Required profile

The candidate is expected to:

- understands the inner working of energetic systems
- knows about optimisation technics
- be familiar with Python programming language
- possess knowledge, if possible, about multi-agent systems and game theory
- be familiar, if possible, with ITE concept

## Contacts

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## Additional information

Deadline for applications: **15/04/26**

Start at fall 2026

The thesis will be based in Nantes with travels to Saint-Nazaire.

An application will be composed of:

- A resume
- A cover letter
- A recommendation letter
- A transcript of grades