



## 2023 Recruitment Job Sheet

### Assistant Professor/Professor

### ENTPE

### (Graduate school of Civil, Environmental and Urban Engineering)

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**Job Title:** Assistant Professor/Professor in big data analysis for transportation and energy engineering

**Discipline(s):** Computer science, Applied Mathematics, Civil or Electrical Engineering (Data analysis, modelling and prediction)

**Specialty(ies):** Learning, Big data, Modelling / Prediction, Transportation Systems, Energy storage and management.

**Laboratory:** Laboratoire « Laboratoire d'Ingénierie Circulation Transport - Eco-gestion des systèmes énergétiques pour les transports » (LICIT-Eco7), unité mixte de recherche de l'ENTPE et de l'Université Gustave Eiffel

**Location:** ENTPE – rue Maurice Audin, 69518 Vaulx-en-Velin Cedex

**Contact(s):** ENTPE :

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LICIT-Eco7 : Ludovic Leclercq, directeur du laboratoire, [ludovic.leclercq@entpe.fr](mailto:ludovic.leclercq@entpe.fr) Tel : 04 72 04 77 16.

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#### 1-Context and issues

A higher education and research institution constituted as a public scientific, cultural and professional establishment (EPSCP) under the supervision of the Ministry of Ecological Transition, the École nationale des travaux publics de l'État (ENTPE) is involved, in training and research, in all the professional fields of planning and management of urbanized territories:

- Buildings and infrastructures ;
- Land use planning, urban policies, and urbanism;
- Transport systems and mobility;

- Soil, water and anthropized hydrosystems: control of environmental impacts and preservation of hydrosystems.

In an increasingly competitive context, the major challenge for the ENTPE today is to position the school even more strongly and to gain recognition for its work in academic and socio-economic spheres, both nationally and internationally. With this in mind, the ENTPE has established a new strategic project that affirms its desire to make the school a pilot and exemplary establishment within the field of ecological and solidarity-based transition.

The school currently trains approximately 700 engineering students, most of whom are recruited from the post-graduate preparatory classes for the grandes écoles. It also offers a range of master's degrees and specialized masters, as well as continuing professional education programs. It will open a Bachelor's degree program in September 2023 with a first year under student status and the other two years under apprentice status with a target enrollment of 50 students per year. The school is part of the Lyon Saint-Etienne site dynamic and works closely with the three other public engineering schools on the site: Insa Lyon, Ecole Centre de Lyon and Mines Saint-Etienne.

The ENTPE is the supervisor of five research laboratories, four of which are affiliated with the CNRS and one with the Gustave Eiffel University. On its site, the School employs and hosts 80 researchers, 60 of whom are permanent. About 100 theses are in preparation.

The management of training is organized within the Education Department (DFI), which relies on the skills of laboratory staff to implement the training programs offered in the institution.

In this context, the ENTPE is looking for a teacher-researcher, to ensure a research mission at 50% of their time within the LICIT-ECO7 laboratory and teaching (50% of their time) in the training courses offered by the school.

### **Description of the themes of the laboratory**

The LICIT-ECO7 laboratory (<https://licit-lyon.eu/>) is a joint research unit under two host institutions: ENTPE and Gustave Eiffel University. Its research themes deal with both mobility and energy management in transportation systems. The laboratory works on the development of innovative tools for smart mobility, studies the impact of new mobility technologies and services, and ways to improve the resilience of transportation systems. The models and tools developed by the laboratory provide concrete support for decision-making. As an applied research laboratory, the LICIT-ECO7 is at the interface between the physical and digital worlds with an experimental basis: the knowledge produced is then validated experimentally using operational data. Thus, the LICIT-ECO7 pays particular attention to the confrontation between data and models, which requires an experimental activity and the increased support of its projects to experimental platforms and living labs.

Finally, the LICIT-ECO7 assumes, on behalf of the ENTPE, a collective training mission, mainly in the field of Transportation and in the fields of computer science and applied mathematics, at the level of bachelor, initial engineering training, co-accredited masters and doctorate. This mission includes taking charge of face-to-face pedagogical sessions, participating in pedagogical engineering (design of pedagogical modules and contribution to the animation of training courses), participating in the supervision of students and in the various exams to which they are subjected.

## **2-Missions**

### **Position**

The assistant professor/professor will be assigned to the LICIT-ECO7 laboratory at the ENTPE site. The research activity of the assistant professor/professor has to be integrated in the overall scientific strategic plan of the unit. His/Her teaching activity is part of the collective and contractual commitment that the laboratory and the DFI define each year. All of the assistant professor/professor's activity is placed under the responsibility of the director of her research unit at the ENTPE.

### **Training activity**

The person recruited will be involved in all the training courses offered by the ENTPE, in particular in the post-baccalaureate Bachelor's program which is due to open in September 2023 (levels L1 to L3), but also in the initial engineering training at the ENTPE, in the Masters programs in which the institution is involved and in the continuing education programs that it implements

The teaching mission consists of contributing to the pedagogical engineering of the various training courses offered by the ENTPE, participating in the steering and management of teaching, providing courses, supervising practical and tutorial work, supervising projects and internships, as well as academic tutoring of students, in particular work-study students, in direct contact with the company's apprenticeship supervisor. The assistant professor/professor must be able to teach in English and at a distance (or in a hybrid format).

The targeted training areas are transportation engineering, mathematics and computer science.

## Research

The LICIT-ECO7 laboratory deals with both mobility and energy management in transportation systems. The proposed position is transversal to the two themes and is intended to address, from a data science perspective, the issues of analysis, monitoring and forecasting of the evolution of the systems studied. It targets research actions aiming at improving, through the analysis and processing of experimental data, the understanding of the functioning of transport and energy systems as well as the behaviors of their actors. It also covers the evaluation of energy needs and environmental externalities of transport systems under real conditions, whether on a microscopic scale (the vehicle or the storage system) or on a macroscopic scale. For example, by relying on the dynamic reconstruction of mobility profiles at the city scale, it is possible to better understand mobility needs, which is essential for the sizing and optimization of transportation supply and the energy distribution/storage network. The position also includes the development of methods for monitoring system states with a high level of spatial resolution. Finally, the position includes the prediction of the evolution of these states in the short and medium term using statistical models trained on historical data. An essential element is the prediction, at different time and space scales, of mobility or energy demand from heterogeneous data sources. This forecast is a key element for the optimization and regulation of transportation and energy systems as well as for their sizing over time. These issues are all the more critical as we seek to develop flexible and resilient systems.

The research project proposed by the candidate will have to be in line with this research orientation of the laboratory by developing original methodological approaches in the field of data science (data analytics), artificial intelligence and machine learning. The data supporting this research could be mobility data (e.g. counting loops, GPS tracks, telephone or Bluetooth data, ticketing data, video captures by drones) or energy-related data (e.g. consumption recorded during journeys on one or more instrumented vehicles, periodic characterizations of the health of storage systems during ageing tests, performance maps measured on engine test benches). The objective is to develop innovative processing methods that consider the specific characteristics of the data studied and, in particular, their heterogeneous nature in terms of sources, formats, availability or resolution. The methodological corpus may refer to classification methods, supervised or not, to those from the field of Bayesian inference or to those from statistical learning. Data imputation methods can be applied to improve the spatio-temporal resolution of system state monitoring. Data fusion methods, such as those derived from data assimilation, are also relevant to improve the accuracy of the monitoring of certain indicators. Data assimilation combines statistical methods with physical models. The person recruited will be able to rely on the laboratory's strong expertise in dynamic modeling of transportation and energy systems. The data studied can be used to predict future developments in transportation and energy systems using statistical learning and neural networks. Particular attention will be paid to the modeling of uncertainties inherent to the studied systems and their propagation, by methods such as Kalman filter. Finally, the issues of low-dimensional datasets (as opposed to big data) and the development of more privacy-friendly, less resource-intensive data processing methods following the principles of frugal AI are relevant research directions in the fields of transportation and energy.

The person recruited as a assistant professor/professor is expected to have an activity of production, supervision and valorization of research. In particular, she will be expected to publish her work in international peer-reviewed journals that meet the standards of her discipline. It is also expected that the candidate will be active in communicating her work to peers, but also to society. She will also contribute to the setting up of research projects in the fields related to

her research activities and may be required to carry out tasks in support of public policies and expertise for the supervisory authorities. She will also participate in the scientific team of her laboratory and will be involved in the reflections on the orientations and the functioning of both the laboratory and the ENTPE. She will contribute to the insertion of the laboratory and the ENTPE in the organizations and initiatives structuring the university site of Lyon/St-Etienne. Finally, the LICIT-ECO7 is strongly committed to the principles of open, reproducible and ethical research. The person recruited will have to adhere to these principles and be a driving force of this dynamic at the laboratory level.

### **3-Expected profile**

- For assistant professor: The candidate must hold a PhD in computer science, applied mathematics and applications of mathematics, or Civil or Electrical Engineering (data processing, modeling, predictions)
- For professor: The candidate must be qualified to direct research, or be able to justify an equivalent level for foreign candidates (publications, doctoral supervision, experience of scientific direction of research projects, teaching).
- The candidate must justify his/her interest, willingness and experience in teaching and pedagogical support of students; he/she should be able to cover a wide spectrum of courses in transport engineering, applied mathematics and/or computer science in order to meet the evolving needs of the training.
- she should have a track record of scientific publications in journals, conference presentations or internationally recognized books in his/her discipline and field of research.
- It is not necessary for the candidate to already have experience in the fields of transport and energy applications, but she should propose a scientific project that is resolutely in line with the above-mentioned themes.
- It is expected that the candidate has a solid expertise in data science: data analysis, massive data processing, machine learning,...
- He (she) must have a good knowledge of the socio-economic world and a vision of the needs for skills in the field of transport and mobility engineering.
- He (she) must be fluent in written and spoken English.

The following elements will also be appreciated by the recruitment panel:

- International experience;
- Have research experience after the thesis;
- Have a good knowledge of their scientific field, of the issues, actors and networks associated with it, both in their discipline and in neighbouring disciplines;
- For senior lecturer positions, have participated in research projects (national and/or European) and for professor positions, have proven experience in setting up and conducting collaborative research projects, transfer/enhancement projects or, more broadly, partnerships;
- Master one or more programming languages (Python, Matlab, C++, java...) in order to implement their own tools.
- Have experience abroad or the ability to mobilize a national and international network.
- Demonstrate the ability to work in a team and multidisciplinary collaboration.

### **4-Application procedures**

Interested parties are to send applications by e-mail to [recrutement-enseignants-chercheurs2023@entpe.fr](mailto:recrutement-enseignants-chercheurs2023@entpe.fr) indicating name, surname, e-mail address and the position applied for.

In return, a message will be sent informing you of the application procedure: this procedure is dematerialized via the website <https://recrutement.entpe.fr>

Application includes a Research and Training project. To prepare their applications and define their research and training projects, and until the closing date for applications, candidates are strongly encouraged to contact the heads of the recruiting units (see contact information on job description).