

# Study of the energy transition in urban environments by hydrogen vector

The energy transition in urban areas is a major issue given that most people live in urban or peri-urban areas. The urban uses of energy are multiple and concern:

- buildings (heating, air conditioning, lighting, ventilation, etc) for housing (collective or individual), tertiary premises, and small industry,
- individual or collective transport of people and goods.

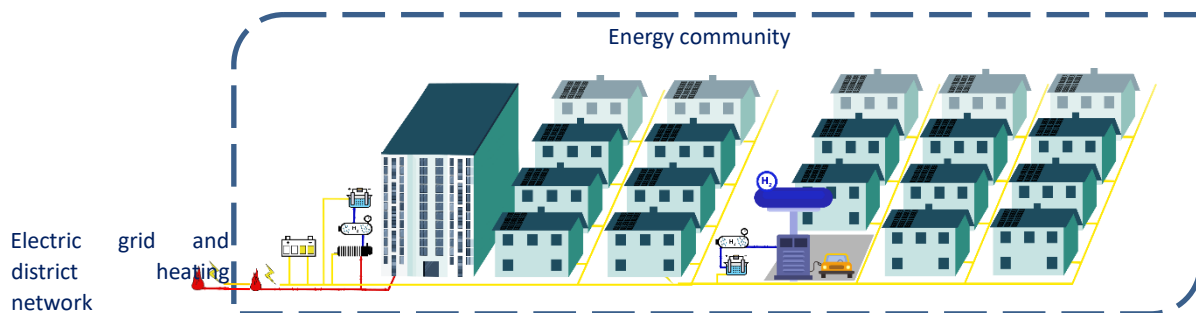
A variety of energy sources and carriers are involved, including electricity, fuels, and, in some cases, district heating networks. According to the International Energy Agency's Net Zero Roadmap – 2023 Update, renewable energy — especially solar photovoltaics — is expected to become the main source of electricity by 2050. The report also points to the growing importance of carbon-free hydrogen.

Electricity from renewable sources enables two main types of energy systems: the traditional grid-connected model, which still dominates today, and a newer, decentralized model built around Energy Communities (ECs). These communities can range from being fully independent to partially or fully self-consuming (SC), with or without a connection to the main grid, and with or without energy storage — either in batteries or hydrogen systems. Integrating urban mobility needs further increases the demand for energy storage.

The interdisciplinary project aims to investigate how an Energy Community (EC) in a renovated urban district can contribute to the energy transition through local production of photovoltaic electricity and carbon-free hydrogen. The studies will be based on energy and environmental aspects but will also take into account economic and legal aspects.

During the internship, an existing model of a district powered by hydrogen systems will be modified to include new buildings, new control schemes and new economic and legislative framework. The updated model will be tested on different application test cases in order to evaluate the energetic, environmental and economic performances of the system.

At the end of the internship, guidelines for the sizing energy systems, managing energy use, and shaping public policy recommendations to update legislative and regulatory frameworks on hydrogen use will be proposed.



**Keywords**—Renewable energy system, net-zero district, multi-criteria evaluation

## Research Team

The intern will be hosted at the FEMTO-ST Energy Department. The ENERGY Department which has about 120 members focuses its research activities on electrical and thermal energies. It complements the research carried out within the six other departments of FEMTO-ST through a systemic energy approach focused on the production and management of efficient, affordable and environmentally friendly energy.

All the work carried out by the department is based on theoretical (modelling, simulation) and experimental approaches related to multi-physical energy systems (electrical, thermal, mechanical, fluidic), often within the framework of national, international, industrial and academic partnerships. This work is carried out by the various teams of the department, but also in link, in a transversal and interdisciplinary way,

The duration of the internship is 5 months. The remuneration offered corresponds to the minimum set by law, i.e. about 600 euros/month.

## Candidate's profile

Master 2 or engineering school in science for engineers, specializing in energy, or electrical engineering, thermal engineering.

Programming knowledge (matlab) is a mandatory. Notions of economy will be appreciated

## Contact

To apply, please send a CV, a motivation letter and the results of the first year of Master 1.

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1

## References

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