

Making the Railway Systems more Sustainable: Concepts for Railway Energy Hubs and Smart Green Railway Stations

We are in the middle of an energy transition towards a fully sustainable energy system and also lifestyle. For this, all areas of our society need to be reconsidered, thus also the way we are moving around for e.g. day trips and of course home-work commute.

In this project our focus is on the railway systems. Even though most trains in the Netherlands are already powered by electricity, there is still a long way to go to make this transport system really sustainable. This is on the one hand due to the current generation mix of our electricity, which is only to some part sustainable. On the other hand, the current Dutch electricity grid becomes more and more congested and by that hinders the needed transition.

Together with a consortium, led by the Dutch railways, we will investigate the role of train stations and the rail infrastructure throughout the energy transition by transforming them in so-called energy hubs. This way, train stations not only become a transportation hub where people come and go with various means of transportation besides trains, but also a key player in the energy transition by forming a central point where energy can flow to and from. The goal is design innovative train stations which are an enabler for further integration of renewable energy generation by acting as a source of flexibility to both the rail-infrastructure, as well as the inner city centers, where most stations are located.

The project consists of two main research objectives:

- 1. Optimized energy management at station level to allow them to become flexible and resilient energy hubs that serve the smart grid.**
- 2. Development of novel integrated energy management solutions that are able to reliably powering the trains using e.g., renewable energy, storage, and regenerative braking.**

For the first objective, the research work will focus new and innovative solutions to manage and minimize energy consumption by optimizing the use of needed resources and reducing the total cost of ownership. A requirement definition and preliminary developments for several use cases and/or pilots need to be researched for the implementation and demonstration.

The considered concepts and components need to come together in an overall energy management framework that is able to manage the energy flows and to integrate renewable energy over time within the rail-infrastructure, including the stations that act as hub. Hereby the energy also must be managed in such a way that the needed (renewable) power is delivered to the trains. In this way, the envisioned research has to lead to a modular and resilient energy management system within the time-varying transportation sector that acts as a key enabling factor of the energy transition. For this, this energy management system must be able to deal with deviations and also interact with its direct surroundings, such as local Distribution Service Operators

Involved partners next to the Decentral Energy Management research group:

- NL: faculty of Behavioural and Management Sciences (UT), Saxion University of Applied sciences, the Aardehuizen community in Olst, and technology provider Loqio.
- International: (mentioned universities/institutes and 'local communities and companies in Denmark and Poland.

Time period: 2023-2027

The 'Energy Management' group at University of Twente has frequently new research projects within the smart energy domain. Therefore, we have regularly open positions for new PhD candidates and Postdocs from a wide variety of disciplines who are open to share and gain knowledge in the context of energy management systems. To get insight in the research directions of our group, we encourage you to have a look at the project descriptions of our ongoing and past projects on their perspective pages.

Due to the multidisciplinary nature of our research group and research projects, the positions may be open for people with a background in Computer Science, Electrical Engineering, (Applied) Mathematics, Embedded Systems, Sustainable Energy Technology, or equivalent. The positions are situated at the University of Twente, and PhD candidates and Postdocs will closely cooperate with each other in an inspiring environment.

OUR RESEARCH GROUP

- For information on the group on 'Energy Management' at University of Twente see <https://www.utwente.nl/eemcs/energy/>;

REQUIREMENTS

The candidate has:

- A Master of Science degree in Computer Science, (Applied) Mathematics, Electrical Engineering, Embedded Systems, Sustainable Energy Systems or equivalent skills for the project.
- Knowledge of energy systems and control theory is a plus.
- Strong analytical, mathematical, and programming skills.
- Excellent teamwork skills and communication skills in spoken and written English.
- Creativity, positive attitude, and perseverance.

OUR OFFER

For PhD positions:

- As a PhD student at the University of Twente you will be appointed on a fulltime position for four years, with a qualifier in the first year, within a very stimulating scientific environment.
- The university offers a dynamic ecosystem with enthusiastic colleagues; Salary and conditions are in accordance with the collective labour agreement for Dutch universities (CAO- NU); As a PhD candidate you will receive a salary ranging from €2.541,- gross per month at the start to €3.247,- in the fourth year.

For Postdoc positions:

- We offer the prospect of a 2-year fulltime contract, within a very stimulating scientific environment.

- The university offers a dynamic ecosystem with enthusiastic colleagues; Salary and conditions are in accordance with the collective labour agreement for Dutch universities (CAO- NU).

CONTACT AND APPLICATION

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Applications including a CV and a motivation letter can be send via email to j.l.hurink@utwente.nl and/or g.hoogsteen@utwente.nl.

