

Faculty of Science and Engineering

Profile report: Tenure Track Assistant Professor with Education Profile

"Hydrogen and Fuel Cells"

(NL: "Waterstof en brandstofcellen")

Discipline: Energy Conversion

Level: Tenure-track assistant professor, educational profile

Fte: 1,0 fte

1. Scientific discipline

This position focuses on the development of innovative teaching methods needed for work force development required for the largescale introduction of hydrogen and fuel cell technologies. Experimental research related to hydrogen and fuel cell systems, covering basic sciences and/or engineering sciences (spanning from electrochemistry to system engineering) is the other focus of the position, and this research will have to be integrated with the development of closely related laboratory courses and teaching programs.

2. Vacancy

This position is opened by the Board of the Faculty (PT/gl/22/00417) and will be embedded in ESRIG, base unit Energy Conversion. The criteria and conditions pertaining to the position are described in the document '[Assistant professor with an education profile](#)'.

3. Selection committee (BAC)

1. Prof. dr. H. A.J. Meijer (M); Director ESRIG and Chair of Centre for Isotope Research (CIO) (Chair)
2. Prof. dr. PV Aravind (M); Chair of Energy Conversion, ESRIG
3. Prof. dr. B Jayawardhana (M); Director of Mechanical Engineering Master Program and Professor of Control Systems, ENTEG
4. dr. E.J. Stamhuis, Director of Education, Energy and Environmental Sciences, and Chair Biomimetics, ESRIG
5. Prof. dr. M. van den Broek (F); IREES, ESRIG
6. Prof. dr. R. Steinberger (M); University of Birmingham;
7. Prof. dr. M Tromp (F); Zernike Institute for Advanced Materials
8. Justin Warners (EES), student member

Advisors:

- Ms. D. Smit (F); HR advisor for ESRIG
- Dr. V. Kyriakou (M); Asst Professor, ENTEG

4. Area of expertise

Hydrogen and fuel cell technologies are getting widespread attention. Large scale hydrogen and fuel cells related industrial and societal programs are being set up in several countries and continents. This is especially true in the northern part of the Netherlands. Several tens of thousands of engineers are expected to be required for such efforts worldwide in the coming years. As present teaching programs at universities cannot fulfil this demand, new teaching programs with innovative teaching methods will have to be developed. The EU programs KnowHy and TeachHy are examples for such initiatives. Blended mode teaching is increasingly becoming attractive. Online teaching, combined with tutoring sessions and lab experience at universities is expected to help in training large number of students in relatively short time spans. The lab experience is expected to be gained from laboratory courses and with the involvement in student research projects. Development of innovative educational concepts such as remote labs and virtual reality tools are also being looked at by the teaching community for imparting practical skills for a large number of students in short time spans. However, hands on experience will still be important and maintaining the right balance is crucial. Considering the hydrogen transition efforts that are taking place in Groningen and the northern part of the Netherlands, such innovative approaches are necessary to make sure that the workforce requirements are met.

Joint research assignments with the industry for the students will also be helpful in developing a workforce that meets the human capital challenges. Hence the candidate, with a background in basic sciences or engineering sciences (physics, chemistry, mechanical engineering, chemical engineering, or related areas), is expected to be able to contribute in developing industrially relevant research topics. For example, still there are concerns about the long-term performance and techno-economic viability of the various subsystems and components involved, making it difficult to take investment decisions. There are also differing opinions on the use of hydrogen carriers as fuels for specific applications. This necessitates continued research efforts to come up with viable cell, stack and system concepts both for fuel production and in its utilization. Working with industry on such topics is expected to help in coming up with contributions supporting the energy (and hydrogen) transition at regional, national and global scales.

5. Embedding: institute (and the base unit)

The position will be embedded in the Energy & Sustainability Research Institute Groningen (ESRIG). This institute is comprised of six base units, with activities ranging from science and engineering to societal applications. ESRIG research is highly multidisciplinary in nature and focuses on fundamental sciences, engineering sciences and social sciences for the development of new and innovative products, processes and societal interventions. The key research domains within ESRIG involve (among others):

- fundamental sciences in energy and sustainability research
- engineering sciences in energy and sustainability research
- innovative societal interventions

This position will be embedded in the Energy Conversion within ESRIG. The Energy conversion group currently consists of a Full Professor, two Senior Scientists, a lab engineer/technician and several PhD candidates and postdoctoral fellows. Research within the Energy Conversion group is focused on the development of hydrogen and fuel cell systems, renewable fuels and integrated energy systems. Research activities span from electrochemistry to system thermodynamics. The Energy Conversion group contributes to the teaching programs Environmental Physics (BSc),

Energy and Environmental Science (MSc), and Mechanical Engineering (MSc). The candidate is expected to focus mainly on the mechanical engineering related teaching efforts. The Energy Conversion group will ensure that the candidate has access to the facilities and resources he/she may need for research activities.

6. Local and (inter)national position

As Groningen is the first 'Hydrogen Valley', that is a leading hydrogen transition region in Europe, large scale collaborations with various parties are needed. In the first place, good connections with other electrochemistry and electrochemical systems related academic groups at the faculty (ENTEG, ZIAM, Stratingh) should be maintained. The Wubbo Ockels School for Energy Transition and Climate Change is the body for inter-faculty collaboration within the university. Moreover, several international partnerships are emerging with other similar regions across the globe. The team members in the group are well experienced in Dutch, European and Global research and teaching initiatives. Delft University of Technology, German Aerospace Center (DLR), University of Birmingham, Indian Institute of Technology Delhi, Hanze University of Applied Sciences and others have been the partners in such initiatives. Last but not least, support for the industry for hydrogen transition is needed.

7. Expected contributions to teaching

The candidate for this position is ideally already didactically schooled or is in the process of becoming schooled, and has a particular interest in teaching. The position, with 60% of the working time devoted to teaching, will focus on the introduction of new courses based on innovative teaching approaches for the Bachelor and Master programmes in related disciplines (BSc in environmental physics, MSc in Energy and Environmental sciences, MSc in Mechanical Engineering). We also foresee the extension of teaching activities to innovative professional development programs (Continuing and Professional Development programs), as thousands of professionals working in the Natural Gas industry in the northern region of the Netherlands will have to be retrained if the foreseen transition to a hydrogen-based economy takes place.

The candidate is expected to take a leading role in the teaching developments mentioned above. Next to that, co-supervision of PhD students is also expected. Ongoing research will have to be integrated in the teaching programs and course contents will be connected to emerging industrial practices. The candidate is expected to contribute to the strengthening of the hydrogen and fuel cell teaching efforts at Groningen University by developing appropriate blended mode teaching programs (similar to the KnowHy and TeachHy efforts and extending these concepts further, for example by introducing advanced serious games, remote lab concepts and/or virtual reality techniques)

Courses for which involvement of the candidate is foreseen include, among others, courses on Hydrogen, Fuels, Fuel Cells, and related laboratory courses. Involvement in supervision of bachelor research projects (Environmental Physics) and master research projects (Energy and environmental Science and Mechanical Engineering) is also expected. The educational activities should be coordinated with teachers from other relevant institutes within the faculty (ENTEG, ZIAM, Stratingh). The students need to be imparted with the mind-set, knowledge, competencies and skillsets required in emerging hydrogen and fuel cell industry in the region and elsewhere. Finally, the candidate is expected to apply for external funding, in particular for specific teaching grants (e.g. EIT, Erasmus plus, local funds) and contribute to strengthening the reputation of the degree programmes at Groningen University.

8. Expected contributions to research

The research activities of the candidate should contribute to existing research lines within the base unit Energy Conversion. The candidate is expected to focus on experimental research related to the development of hydrogen and fuel cell systems, spending 30% of his or her working time. The candidate is expected to help also to connect the hydrogen and fuel cell research activities within ESRIG with other major research groups within the university (physics, chemistry, chemical engineering, material science, control systems, etc). Setting up joint research initiatives (and student assignments) with industry is important. Such embedding ensures that his/her teaching activities are well integrated with cutting edge research and major industrial initiatives in the field. This includes the translation of relevant research activities into educational programmes (including the supervision of bachelor and master students). The research group Energy Conversion is already involved in several industrial projects related to hydrogen and fuel cell technologies. Such efforts are extremely important from an industrial perspective in the Northern region of the Netherlands. The candidate is expected to reinforce these collaboration initiatives.

9. Expected contributions to the organization

The candidate is expected to have an active interest in, and provide a positive contribution to, the management and organizational tasks (nominally 10% of the working time). Laboratory (hydrogen and fuel cell laboratory) and institute management support is expected. At the faculty level, the candidate will contribute to the organization of the faculty, for example by participating in working groups and committees in the area of education. The candidate is also expected to participate in and/or connect with relevant national and international initiatives and organizations. Additionally, as teaching approaches are being redefined almost continuously, and new ways of teaching are emerging (online education, blended mode teaching, life-long learning etc) the candidate is also expected to help in strategically positioning the teaching programs within the university well aligned with changes taking place nationally and internationally.