

Faculty of Science and Engineering

Profile report: Energy systems and conversions / Energie systemen en conversies

- Discipline: Mechanical Engineering, Process Design, Energy systems, Chemical conversions
- Level: Full professor
- Fte: Full time (1,0)

1. Scientific discipline

Mechanical engineering is the discipline that applies engineering, physics, and materials science principles to design, analyze, manufacture, and maintain mechanical systems. At the University of Groningen the focus of this Mechanical Engineering position lies on process design with emphasis on energy systems and conversions.

2. Vacancy

This position is opened by the Board of the Faculty of Science and Engineering (letter with reference JPT/gl/17/00662). The candidate will be embedded in the Engineering and Technology Institute (ENTEG) of the Faculty of Science and Engineering (FSE) of the University of Groningen (UG).

3. Selection committee (BAC)

- Prof. Dr. Ir. J.M.A. Scherpen (chair, director ENTEG)
- Prof. Dr. F. Picchioni (deputy director of bachelor program chemistry and chemical engineering)
- Prof. dr. ir. H.J. Heeres (chairman ENTEG, head of the green chemical reaction engineering cluster)
- Prof.dr. B. Noheda (Professor in Functional Nanomaterials)
- Prof dr.-ing. Hartmut Spliethoff (Process design, TUMunche)
- Prof. dr. W. de Jong (Honorary professor Integrated Thermochemical Biorefineries and professor TU Delft)
- Martine Schouten Hoogendijk (student member)

Advisors

- Prof.dr. H.A.J. Meijer (ESRIG)
- Mr. H. Y. Haagsma (HR advisor)
- Dr. K.E. Voskamp (scientific coordinator ENTEG)

4. Research area

The development of efficient energy systems and sustainable, low-carbon-emission energy generation processes are essential. It requires identification of attractive fuel sources, preferably renewable though advanced fossil options are also possible, and technologies to use those sources in efficient, environmentally benign ways. This goal calls for comprehensive understanding of many interrelated phenomena and requires a highly multidisciplinary approach with expertise including energy transport, chemical processes, mechanical processes, efficiency design and multiscale materials, from nanostructures to bulk functional composites.

The current position has been created to strengthen the research efforts in this emerging area in the ENTEG institute of the Faculty of Science and Engineering (FSE). The research line will contribute to the necessary breakthroughs in the area within the mechanical engineering context. Examples of research topics (not limited) can be found in the fields of advanced energy carrier technologies and energy conversion devices such as fuel cells, hydrogen storage systems, hybrid transportation and power systems, as well as "smart" ways of accomplishing chemical-to-work energy conversions.

5. Embedding: institute (and basic unit)

ENTEG aims at performing technology-driven scientific research. It focuses on the creation and manufacture of innovative products and production strategies in the different mechanical, physics, chemistry and biotechnology based sectors. The research of ENTEG is conducted in three key research domains:

- the application of fundamental sciences to the design of new (sustainable) product and research in the area of product and production technology for (bio)chemical based products,
- the development of quantitative and analytical theories and methodologies for model-based design and control of complex industrial processes and systems and
- research in advanced production engineering aiming at improving the production processes of increasingly complex materials

The candidate is expected to create and chair a new basic unit in the direction of Mechanical Engineering with a focus on Energy systems and conversions. This new unit, Process Design, is expected to have close research and teaching links to the Chemical and Mechanical Engineering oriented units of ENTEG - the research units Green Chemical Reaction Engineering (GCRE), Product Technology (PT), Advanced Production Engineering (APE) and Discrete Technology and Production Automation (DTPA). The GRCE research unit focuses on the development of highly intensified catalytic methodology and technology for biomass conversion to biofuels and biobased chemicals. Research within PT is focused on the design of new or improved chemical products. Particular attention is devoted to the development of new catalytic systems and of polymeric products for specific applications. The APE research unit focuses on mechanical precision engineering and on material science. Research within DTPA, on the other hand, is focused on the dynamical modeling, analysis and systems engineering of complex electro-mechanical systems.

Next to the mentioned to-be-created new basic unit with a focus on Process Design, two additional new basic units will be created viz. a Mechanical Engineering unit with a focus on Dynamics and Vibration and one with a focus on Engineering Materials.

6. Local and (inter)national position

Engineering research at the University of Groningen is embedded in a broad scientific community. The mechanical engineering research at the University of Groningen will have a defining feature unique in the Netherlands: its research can cover the entire innovation cycle on several topics, from basic science to the cautious development of processes and products. Within the Faculty of Science and Engineering of the University of Groningen, basic and applied research on energy systems is performed within the Energy and Sustainability Institute Groningen (ESRIG),¹ Zernike Institute for Advanced Materials² and Stratingh

¹ See <http://www.rug.nl/research/esrig/>

² See <http://www.rug.nl/research/zernike/>

Institute for Chemistry³ which could be excellent partners for collaboration in multidisciplinary projects in the field of energy systems and conversions.

In the Netherlands research in Mechanical Engineering is done at Delft University of Technology, Eindhoven University of Technology and University of Twente. Research groups that are related to Process Design for Energy Systems and conversions at these universities focus on thermo fluids engineering, energy technology and process technology. Worldwide, research in Mechanical Engineering is present at most technical universities providing mechanical engineering master and bachelor program.

7. Expected contributions to research

The candidate is expected to initiate and set up his/her own basic unit and research line in the field of Energy systems and conversions. The research should have good (inter)national visibility, outstanding reputation and lead to publications in top ranked journals within the discipline. The research is expected to cross-fertilize the existing research within the institute and should lead to a strengthening of the international reputation of the unit and the institute. Obtaining substantial external funding and coaching of two young tenure tracker staff members that will also be affiliated to the to-be-created basic unit are crucial. Supervision of PhD students is an important part of the research activities.

8. Expected contributions to teaching

The candidate will contribute 40% of his/her time to the teaching programs at the University of Groningen, in particular the Bachelor's and Master's degree programs in Chemical Engineering,⁴ Industrial Engineering and Management⁵ and other engineering programs with a focus on process design related courses.

The candidate is expected to become actively involved in the to-be-developed Master's degree program in Mechanical Engineering (start date September 2019) and be involved in the teaching activities related to the track Process Design for Energy Systems (e.g. supervising of master research and design projects and the design and teaching of new course modules like Advanced Process and Energy Technologies and Advanced and Sustainable Process Design). The candidate should have excellent teaching skills and is expected to be an inspiring and innovative teacher.

9. Expected contributions to the organization

The candidate is expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. At the level of the Faculty of Science and Engineering, the candidate will contribute to the organization of the faculty, for example by participating in working groups and committees, in the fields of teaching, research and management. The candidate will participate in relevant national and international organizations.

³ See <http://www.rug.nl/research/stratingh/?lang=en>

⁴ Details of the BSc Chemical Engineering program can be found in <https://www.rug.nl/ocasys/fwn/vak/showpos?opleiding=4965> and that of the MSc Chemical Engineering program can be read in <https://www.rug.nl/ocasys/fwn/vak/showpos?opleiding=3235>

⁵ Details of the BSc IEM program can be found in <http://www.rug.nl/ocasys/fwn/vak/showpos?opleiding=3753> and that of the MSc IEM program can be read in <http://www.rug.nl/ocasys/fwn/vak/showpos?opleiding=3754>

