

Faculty of Science and Engineering (FSE)

Profile report: Sustainable Process and Product Design (SPD)

[NI: Duurzaam Ontwerp van Chemische Processen en Producten]

Discipline: Chemical Process Engineering, Process Design, Sustainable Processes

Level: Assistant Professor

Focus: Education

Fte: 0.8-1.0 fte

1. Scientific discipline

Sustainable process design aims to develop industrial processes and products that minimize their environmental impact while maintaining economic viability. It involves the integration of chemical and process engineering principles to design industrial-scale processes that use renewable resources, produce less waste, have lower energy consumption and possibly contribute to the general concept of circular economy. The goal is to create processes that are sustainable over the long term, balancing technical, economic, and environmental factors.

2. Vacancy

This position is opened by the Board of the Faculty of Science and Engineering (to be added) and will be embedded in the Engineering and Technology institute Groningen (ENTEG), in the cluster Chemical Engineering. The position falls within the framework of the faculty's career system [Career Paths in Science and Engineering](#). As the focus domain of the position is education, the criteria of the career path with a focus on education apply. Please see the link for more information.

3. Selection committee (BAC)

- Prof. dr. G.J.W. Euverink, Professor of Products and Processes for Biotechnology in the Biobased Economy, Educational director, ENTEG
- Prof. dr. B. Jayawardhana, Professor of Mechatronics and Control of Nonlinear Systems, Scientific director, ENTEG;
- Prof. dr. ir. H.J. Heeres, Professor of Green Chemical Reaction Engineering, ENTEG;
- Prof. dr. R. Bose, Associate Professor of Polymer Engineering, programme director BSc Chemical Engineering, ENTEG
- Prof. dr. M. Ghanchi Tehrani, professor of Dynamics and Vibration, programme director Msc Mechanical Engineering ENTEG
- Prof. dr. Andrea Pucci, Professor of Industrial Chemistry, University of Pisa
- student (tbd)

Advisors:

- Dr. ir. J.G.M. Winkelman, Director EngD Sustainable Process Design
- Dr. P. Karka, Assistant Professor in Sustainable Process Design
- Prof. dr. F. Picchioni, Professor of Product Technology, ENTEG
- F. Salverda, HR advisor, ENTEG
- Dr. K.E. Voskamp, Scientific coordinator, ENTEG

4. Area of expertise

Process design is a critical element of sustainable chemical engineering, as it involves the development of efficient and effective processes for the production of chemicals and materials with minimal environmental impact. The objective of sustainable process design is to optimize the use of resources and energy, reduce waste and emissions, and minimize the environmental impact of chemical processes throughout their lifecycle.

Sustainable process design also aims to reduce energy consumption and greenhouse gas emissions of existing processes. By optimizing process conditions, improving energy efficiency, and using renewable energy sources, sustainable process design can help to reduce the carbon footprint of current chemical processes. This is particularly important given the chemical industry's significant contribution to global greenhouse gas emissions.

Furthermore, sustainable process design can foster the inception of novel, environmentally friendly products and processes. By adopting renewable feedstocks, developing biodegradable and/or recyclable materials, and minimizing the usage of hazardous chemicals, sustainable process design can facilitate the creation of products that are more ecologically sound and safer for the environment. Integral to this is the holistic assessment of a product's or process's entire lifecycle, encompassing raw material extraction to disposal or recycling. Such an approach requires a system-focused mindset that evaluates not only the process's environmental impact but also its implications for society and the economy.

We need to convey this holistic, systems-oriented perspective to our students. The current position is meant to modernize, in terms of teaching and assessing methods, our existing learning lines and develop new advanced courses related to process design for green and sustainable chemical processes. Teaching responsibilities for the to be appointed candidate are in the new Engineering Doctorate (EngD) programme Sustainable Process Design, as well as in the Bachelor and Master programmes of Chemical Engineering and Industrial Engineering and Management.

5. Embedding: institute (and base unit)

The research institute ENTEG (www.rug.nl/enteg) is the engineering science and technology institute of the Faculty of Science and Engineering of the University of Groningen. ENTEG research is highly multidisciplinary in nature and focuses on fundamental and engineering research on the development of new and innovative processes and products. The aim is to contribute to the smart and circular society. The research of ENTEG is conducted in three key research domains:

- Sustainable chemical engineering & biotechnology;
- Mechanical, materials & robotics engineering;
- Optimization, systems & control.

The new position will strengthen the teaching and research activities of the Chemical Engineering cluster. Depending on the experience and research interests of the candidate, the position will be embedded in either the basic unit Product Technology (PT), Green Chemical Reaction Engineering (GCRE), or Products and Processes for Biotechnology in the Biobased Economy (PPBBE). These units typically consist of 1 or 2 full professors, accompanied by associate professors, tenure track assistant professors and a team of PhD-students and postdoctoral fellows. The staff is strongly linked to the new EngD programme and the degree programmes in Chemical Engineering and Industrial Engineering and Management.

Research of the basic units PT, GCRE and PPBBE has a pivotal role in industrial projects within the renewable carbon domain. It is focused on the development of highly intensified thermal and catalytic reactor technology, of renewable products such as fuels and chemicals, and of biotechnological processes in the biobased economy. The research includes the use of green solvents (e.g., supercritical CO₂) for process design and advanced material design for the circular economy.

The staff of the PT, GCRE, and PPBBE units is the core teaching staff for the EngD programme, and the Bachelor and Master programmes in Chemical Engineering and in Industrial Engineering and Management (track Sustainable Process Engineering (SPE)). The candidate is expected to be involved in both degree programmes and the EngD programme, and as such will be involved in hard-core process design activities.

6. Local and (inter)national position

An EngD is a specialized postgraduate degree emphasizing design-oriented engineering, tailored to address industry and societal demands for innovation in products, processes, and systems. The Sustainable Process Design EngD is comparable to two programmes of other (technical) Dutch universities: Process and Equipment Design (TUDelft) and Process and Product Design (TU/e). Compared to these programmes, the EngD programme at the University of Groningen is embedded in a large classical research university with expertise across all relevant fields, such as economics, social sciences, environmental sciences, and law, ensuring a well-rounded and interdisciplinary approach to problem-solving. This can be especially important when addressing complex and interconnected issues related to sustainability in industry. Internationally similar programmes exist. They all typically focus on applying advanced technical knowledge to practical technological issues, driving innovation in industry and society, comparable to the Dutch EngD programmes.

In addition, the research activities of the Chemical Engineering units within ENTEG have a by far stronger chemistry and product oriented flavour than those of comparable research groups in the technical universities in the Netherlands offering a unique opportunity for the development of integrated processes and products.

7. Expected contributions to education

The candidate will, at the level of Assistant Professor, contribute 60% of his/her time to education. More specifically, besides the actual lecturing, the candidate is expected to take a leading role in innovating the teaching, setting up courses, and assessment methods for courses such as:

- Advanced Process Development (EngD)
- Process Design Project (EngD)
- Process Design (BSc CE)
- Product focused Process Design (MSc CE)

However, in the longer term, we certainly do not expect the candidate to be limited to just these areas of the curriculum. The candidate is expected to critically evaluate the current teaching and assessment methods and potentially develop more modern approaches, incorporating elements such as groups work, modelling and hybrid (combining online and onsite) teaching methods, thus aligning with industrial best practices. In addition, the candidate is also expected to develop new courses and supervise design projects for the EngD programme.

8. Expected contributions to research

The candidate will, at the level of Assistant Professor, contribute 30% of his/her time to set up a research line with a focus on sustainable processes and product design within either the GCRE, PT, or PPBBE unit, related to the ongoing activities in this unit. The embedding ensures that the teaching activities are informed by relevant and state-of-the-art research, contributing to cutting-edge advancements in the field. This includes translating relevant research activities into the process and product design elements of the relevant educational programs, as well as supervising bachelor and master students in courses with research elements, and supervision of EngD and PhD students.

Several industrial partners are already collaborating with the research unit staff on related topics, which is highly attractive from an industrial perspective, and especially beneficial for the chemical clusters in the North of the Netherlands (Eemshaven/Delfzijl and Emmen). The candidate is expected to enhance these industrial partnerships and bring a "sustainability"-oriented viewpoint to various existing and upcoming projects.

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. The candidate will furthermore contribute to the organization of the faculty, for example by participating in working groups and committees, in the domains of education, research and management. The candidate will contribute to relevant organizational activities on the national and international level.