Developing a digital twin of a large-scale Alkaline Electrolyser using Aspen Plus

Client	ENTRANCE, Centre of Expertise of Energy Felipe H. Ravaglio Pasquini
Related project	
Start date	Flexible
Suitable for training course(s)	Master EMRE, SESyM or other students with a background in energy systems, chemical or process engineering
Learning Community	

Assignment description

This master's thesis focuses on developing a digital twin of a large-scale Alkaline Electrolyzer using Aspen Plus. The objective is to construct a process model that accurately represents industrial-scale electrolysis and validate it using real operational data from the Hydrohub project. The research will involve analysing the effects of key operating conditions, such as KOH concentration, temperature, and pressure, on system performance. Additionally, the project will aim to optimize the model to improve efficiency and scalability.

The assignment is suitable for master's students with a background in energy systems, chemical or process engineering. Prior experience with process simulation software, particularly Aspen Plus, is advantageous but not mandatory. The research contributes to the advancement of large-scale green hydrogen production, supporting the transition to sustainable energy systems.

Assignment

This master's thesis focuses on developing a digital twin of a large-scale Alkaline Electrolyser using Aspen Plus. The aim is to create a detailed process model that replicates **industrial-scale** electrolysis and to validate its accuracy using real operational data from the Hydrohub project. The study will investigate how key operational parameters, such as KOH concentration, temperature, and pressure, influence electrolyzer performance. The ultimate goal is to optimise the model to improve efficiency and scalability, contributing to the advancement of large-scale hydrogen production.

Research Question

How can a digital twin of a large-scale Alkaline Electrolyser be developed and validated using Aspen Plus to accurately predict system performance under varying operational conditions?

Problem statement

The large-scale implementation of Alkaline Electrolysers is critical for the expansion of green hydrogen production. However, accurately predicting and optimising their performance remains a challenge due to complex interactions between operational parameters. Current models often lack validation with real industrial data, limiting their reliability for upscaling. This research aims to develop a validated digital twin in Aspen Plus to improve predictive accuracy, optimise system performance, and support the efficient scale-up of Alkaline Electrolysers for industrial applications.

General information

Final Product	Master's thesis on the topic of modelling and validation of a large-scale Alkaline electrolyser using Aspen Plus
Location	ENTRANCE, Centre of Expertise of Energy, Zernikelaan 17
Parties involved	
Contact person	Felipe H. Ravaglio Pasquini, f.h.ravaglio.pasquini@pl.hanze.nl
Guidance	Felipe H. Ravaglio Pasquini
Details	

The Alkaline electrolyser that will be studied is part of the Hydrohub Project. You can have more information about it in the video below (in Dutch):

https://www.linkedin.com/feed/update/urn:li:activity:7115231575985778691/

What are we and where can you find us?

ENTRANCE is a learning knowledge community, in which students and teacher researchers from various programmes work together with researchers, companies, governments and civil society organisations to accelerate the energy transition.

ENTRANCE is the place where, as a student, you work together with lecturers, researchers, businesses, governments and/or civil society organisations on complex issues. We do this at the following locations:

- Location Proeftuin, Zernikelaan 17

- Location Energy Academy Europe, Nijenborgh 6.

What do we offer?

EnTranCe offers you a multidisciplinary, inspiring learning, working and research environment in which you can develop the competencies needed to shape and accelerate the energy transition. There is room for collaboration with professors, researchers, lecturers and the professional field. In addition, you will be supervised by professionals who are part of the EnTranCe Learning Communities (ELC).

Contact us

Are you interested in the vacancy? Do you have questions or would you like to apply directly?

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