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Field demonstration of large scale stationary power and CHP fuel cell system

GA No. 621256

DEMCOPEM 2MW

Demonstration of a combined heat and power 2MWe PEM fuel cell generator and integration into an existing chlorine production plant

Deliverable No.	DEMCOPEM-2MW D3.2	
Deliverable Title	Report on the computer model of the PEM unit, comprising flow diagrams and results of various simulations to optimize the design of the unit	
Dissemination level	Public/Confidential/Restricted	Confidential
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Publishable summary

This report is dedicated to the extension and application of the simulation model developed for the DEMCOPEM-2MW PEM plant. The model is developed within Work package 3 of the project, dedicated essentially to modelling of the process taking place in the 2 MW PEM plant as well as to measurements evaluation and validation. Within WP3, this report D3.2 is dedicated to tasks 3 and 4 which are "Process simulation of the PEM generator with a computer code" and "Computations with the computer model".
The model calculates the mass and energy balance for the plant considered in this project, including the PEM and its main balance of plant components (heat exchangers, blowers, pumps). The model has been developed with ASPEN Plus®, with particular attention to modelling PEMFC performances through a specific custom model depending on the operating and stream conditions (temperature, pressure and composition of inlet streams, current density).
Within D3.1, the simulation was validated based on the layout and performances of the PEM plants of Solvay in Lillo (1 MW plant plant) and of the Akzonobel in Delfzijl (70 kW plant), using information on plant layout and cell behavior (voltage, temperatures, reactant flow rates and compositions) provided by NFCT and based on information about the 2 MW plant expected layout provided by MTSA.
Within D3.2, the simulation model is further refined according to the actual specifications of the 2 MW plant, both referring to the PEM performances (refinement of V-I curve prediction) and to plant components (saturator, heat exchangers, air blower, hydrogen recycle compressor). Moreover, a new section of the model is setup for the simulation of pressure losses in the pipeline network connecting the saturators and the fuel cells (air and hydrogen loop) as well as for the cooling water loop.
Then several simulations are performed to predict the plant performances when the plant moves form BOL (beginning of life) operating conditions of the fuel cells to mid and EOL (end of life) conditions, investigating the effects of different set point options for air and fuel utilization as well as the effects of a different plant arrangement where unused hydrogen exiting the fuel cell is burned in a combustor to generate additional export heat. Results show possible operating strategies to keep the plant power output close to the nominal value during lifetime, while minimizing efficiency losses.

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