

INTEGRATION OF AN ABSORPTION CHILLER & HIGH TEMPERATURE FUEL CELL FOR POLYGENERATION

OVERVIEW

Polygeneration of hydrogen, heat, and power has been shown to improve overall plant efficiency by creating more products and introducing synergy which improve fuel cell performance (Figure 1). The integration of an absorption chiller with a high temperature fuel cell for polygeneration of combined cooling, heating, hydrogen, and power is studied. Steady-state and dynamic computer models are utilized to study the feasibility of the system. Various configurations are analyzed using the steady-state model. A dynamic model is used to study the real world operating characteristics of the system.

GOALS

- Integrate existing fuel cell and chiller models
- Optimize the configuration for maximum production of cooling, heating, hydrogen, and power
- Study the dynamic response of the system in order to understand feasibility
- Simulate building load dynamics using data from actual buildings

RESULTS

An Aspen Plus model was created to study the polygeneration system in steady state. Results from this model were used in order to identify favorable streams for chiller integration. Preliminary model results indicate that system exhaust is not hot enough to drive a double-effect absorption chiller. Streams within the system were analyzed for potential integration with a chiller.

Results show that the stream exiting the oxidizer has enough heat to drive a chiller while still

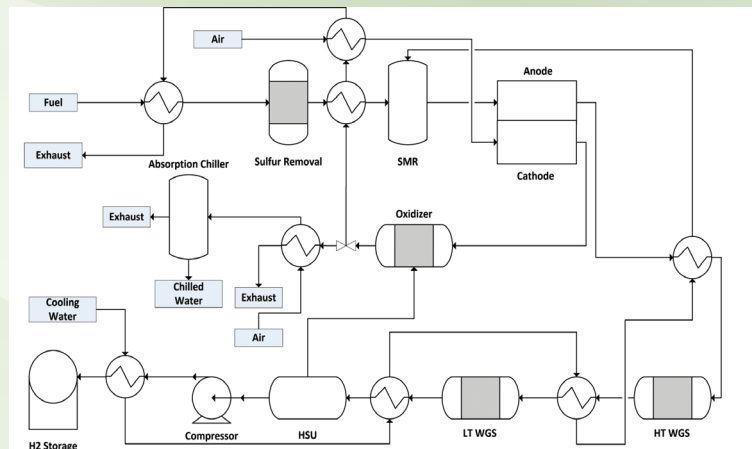


Figure 2: Possible configuration for polygeneration

RESULTS (continued)

providing enough heat for preheating fuel and air inlet streams. This can be achieved by either utilizing extra heat from other parts of the system, directing a portion of the oxidizer exhaust to the chiller, or a combination of the two (Figure 2).

A comparison between the SOFC and the MCFC driven systems shows that more cooling can be generated by the SOFC system (Figure 3). This may be due to a greater mass flow required to cool the oxidizer stream which gives the SOFC system an advantage for chiller integration.

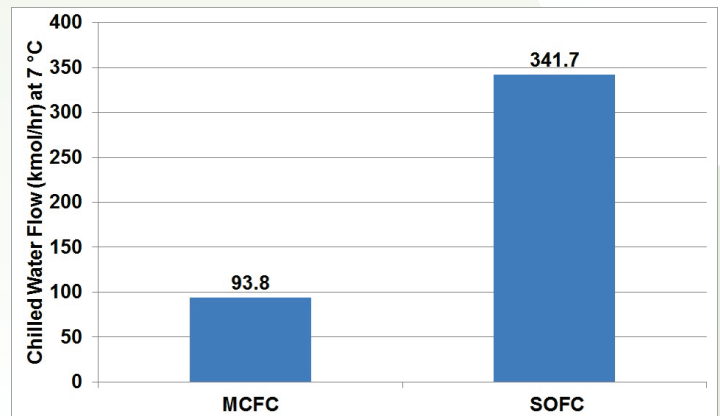


Figure 3: Comparison of chilled water flow

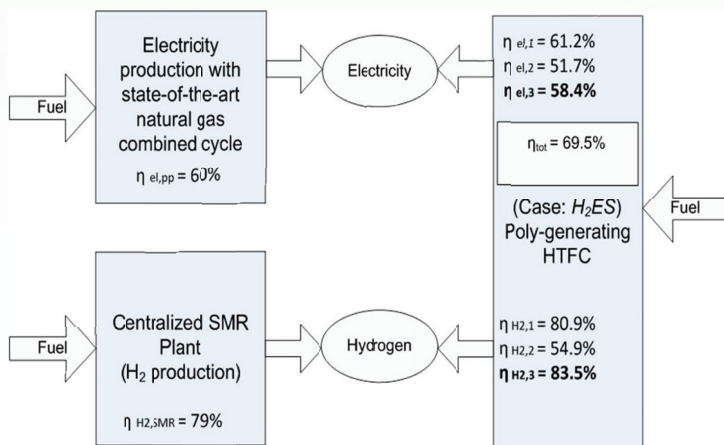


Figure 1: Margalef, P, Brown, T, Brouwer, J, and Samuelsen, S, Journal of Power Sources, 2011.

PUBLICATIONS

ALTERNATIVE SEPARATION AND PURIFICATION OPTIONS FOR TRI-GENERATION AND CHILLER INTEGRATION (2013). ICEPAG 2013, Irvine (J.F. Kast, D.J. McVay, J.B. Brouwer, and G.S. Samuelsen).

PERSONNEL

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