Integration of fuel cell technology in the Cuban sugar industry: some sustainability aspects assessed

Jo Dewulf[1], Yannay Casas[2], Luis E. Arteaga[2], Mayra Morales[2], Herman Van Langenhove[1], Elena Rosa[2]

[1] Ghent University, Coupure Links 653, 9000 Ghent, Belgium

[2] Central University of Las Villas, Road to Camajuaní Km 5.5. Santa Clara, c/p 54830, Villa Clara, Cuba.

In order to mitigate the emissions of greenhouse gases and fossil fuel consumption several researchers have focused their efforts on renewable energy sources and on developing new and more efficient technologies for energy production. In Cuba, sugar cane is a key resource giving potential for a more bio-based society, and there is room to introduce more efficient technologies. Sugar cane is the feedstock to produce bio-ethanol but also for other products as well. There are different industrial valorization scenarios, including sugar factories, alcohol distilleries, integrated sugar and alcohol plants, and electricity cogeneration plants using bagasse as fuel. The diversification of sugarcane as feedstock is a logical and economically advantageous strategy of development, which considers the high added value products and services that can be obtained from cane and its derivatives.

In this contribution, we look how an efficient energy conversion technology, i.e. Solid Oxide Fuel Cell (SOFC) affects the efficiency and environmental sustainability of the traditional sugar industry through a case study in Central Cuba. After establishing the alternative process scheme with integration of SOFC with ethanol steam reforming, the new process is benchmarked in terms of thermodynamic efficiency (exergy analysis), the change in the renewability degree of the resource base and in terms of environmental impacts point of view (greenhouse gases and acidification).

Reading material:

Casas, Y., Dewulf, J., Arteaga-Pérez, L.E., Morales, M., Van Langenhove, H., and Rosa, E. (2011) Integration of Solid Oxide Fuel Cell in a sugar-ethanol factory: analysis of the efficiency and the environmental profile of the products. Journal of Cleaner Production 19: 1395-1404.

Casas, Y., Arteaga, L.E., Morales, M., Rosa, E., Peralta, L.M., and Dewulf, J. (2010) Energy and exergy analysis of an ethanol fueled solid oxide fuel cell power plant. Chemical Engineering Journal 162: 1057-1066.