

RESUMEN

Mayorca, Alfredo

Analisi Exergetico e Termoeconomico di un sistema ibrido composto da una Cella Combustibile a carbonati fusi e una Microturbina a gas per la produzione di energia elettrica e termica.

Tutor academico: Vittorio Verda, 2010.

Palabras claves: Celda combustible, Microturbina a gas, Reformer, Exergia, Entalpia, Entropia, Costo Exergetico, Costo Termoeconomico, Eficiencia, Irreversibilidad.

El presente trabajo es un analisis exergetico y termoeconomico di un sistema ibrido compuesto por una celda combustible a carbonato fluido (MCFC, Molten Carbonate Fuel Cell) acoplada a una microturbina a gas, per la generaci3n de energa electrica y t3rmica. El conjunto produce una potencia electrica en el punto inicial de proyecto de 840 kW, alcanzando un valor de eficiencia electrica de 51,5%. La instalaci3n adem3s de la producci3n de energia electrica suministra un flujo calorico a un digestor anaerobico de 413,7 kWt para la producci3n de biogas (mezcla de varios tipos de gases en su mayoria metano entre 50%-80%, dioxido de carbono y nitrogeno, producto de la reacciones de biodegradaci3n de la materia org3nica, mediante la acci3n de microorganismos). Este biogas es utilizado como combustible garantizando la autosostenibilidad y la integraci3n entre el digestor anaerobico y el sistema hibrido.

Este tipo de instalaci3n, fue estudiado solo a nivel numerico y no experimental, siendo en estos momentos no comerciable. Por lo tanto puede representar una referencia innovativa para la generaci3n de electricidad, con una mayor eficiencia y un menor impacto ambiental por emisiones contaminantes

La metodolog3a de analisis utilizada es la Thermoeconomic Functional Analysis que, a partir del analisis de rendimiento del segundo principio de cada componente del sistema, permite determinar el costo de cada flujo exergetico, expresos en unidades exergeticas (costos unitarios exergeticos) y monetarios (costos unitarios termoeconomicos).

Por ultimo, se realiz3 la optimizaci3n del sistema variando parametros de diseo tomando en consideraci3n dos objetivos: la maximizaci3n de la eficiencia del sistema y la minimizaci3n del costo de la electricidad.

ABSTRACT

Mayorca, Alfredo

Exergetic and Thermoeconomic Analysis of a Hybrid System composed by a Microturbine and a Fuel Cell for heat and electricity production

Academic Adviser: Vittorio Verda, 2010.

Keywords: Fuel cell, Microturbine, Reformer, Exergy, Entalpy, Entropy, Exergetic Cost, Thermoeconomic Cost, Efficiency, Irreversibility.

This work is an exergy and thermoeconomic analysis of a hybrid system composed by a Molten Carbonate Fuel Cell MCFC, coupled to a gas microturbine, for the generation of electrical and thermal energy. The group in the design point produces 840 kW of electrical power, reaching an efficiency of 51.5%. The installation as well as production of electric power supplies a heat flux of 413,7 kWt for an anaerobic digesters to produce biogas (a mixture of several gases methane mostly between 50% -80%, carbon dioxide and nitrogen product of the reactions of biodegradation of organic matter through the action of microorganisms). This biogas is used as fuel for ensuring self-sustainability and the integration between the anaerobic digester and the hybrid system. This type of installation was studied only at the numeric and non-experimental, being at present not marketable. Therefore may represent an innovative reference for generating electricity with greater efficiency and lower environmental impact emissions. The analysis methodology used is the Thermoeconomic Functional Analysis, where starting by the second thermodynamic analysis on each system component, is possible determine the cost of each flow exergy, expressed in exergetic units (exergetic unit cost) and monetary units (thermoeconomic unit costs).

Finally, we performed the optimization of design varying certain parameters of the system taking into account two objectives: maximizing the efficiency of he system and minimizing the unit cost of electricity.