

EFFICIENCY AND ECONOMICS ANALYSIS OF PROTON EXCHANGE MEMBRANE
FUEL CELL

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ABSTRACT

Recently, interest in fuel cells has increased sharply and progress towards commercialization has accelerated. As a result, practical fuel cell systems are now becoming available and are soon expected to take a growing share of the markets for automotive power and generation equipment once costs fall to competitive levels. Proton Exchange Membrane (PEM) fuel cells using pure hydrogen as fuel is employed to produce electricity due to some advantages, like simplicity, effectiveness, low operating temperature, easy maintenance. Proton Exchange Membrane (PEM) fuel cells is a type of fuel cell which is attractive for low power levels and for application that need quick start up and response to load changes. PEM fuel cells as an alternative power source has its electrical efficiency and also power output directly related to the economics. It's obvious that if to be used in automobile applications, the PEM fuel cells will have its efficiency and economics playing a vital role. Both the economics and efficiency is related. The relationship is being analyzed in this thesis with in depth understanding on the working concept of PEM fuel cell. The relationship is not a single value but it's a function utilizing various parameters.

ABSTRAK

Kontemporari ini , minat terhadap Fuel Cell telah meningkat dan ia dalam proses pengkomersialan. Jika harga Fuel Cell mencapai harga yang optimum ia akan pasti digunakan dalam pasaran automobile. Proton Exchange Membrane (PEM) Fuel Cell menggunakan hidrogen asli sebagai pemangkin untuk menjana tenaga elektrik. Terdapat pelbagai kebaikan dalam menggunakan PEM Fuel Cell dimana antaranya adalah , mudah digunakan , efektif , suhu operasi yang rendah , penyenggaraan yang mudah. Proton Exchange Membrane (PEM) fuel cells adalah sangat diminati dalam aplikasi yang memerlukan kuasa yang rendah , proses pemulaan yang cepat dan respon kepada penukaran beban. Ekonomi dan keefisienan PEM fuel cell mempunyai hubungan. Hubungan antara ekonomi dan keefisienan PEM fuel cell akan dianalisis dalam thesis ini dengan pemahaman yang mendalam tentang operasi PEM fuel cell. Hubungan ekonomi dan keefisienan adalah merupakan satu fungsi yang bergantung kepada pelbagai parameter dan tidak merupakan satu nombor.

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LIST OF SYMBOLS

\$	-	Dollar Sign
kW-h	-	Kilo-Watt per Hour
H ₂	-	Hydrogen molecules
H ₂ O	-	Water molecules
O ₂	-	Oxygen molecules

LIST OF ABBREVIATIONS

PEM	-	Proton Exchange Membrane
PEMFC	-	Proton Exchange Membrane Fuel Cell

CHAPTER 1

INTRODUCTION

Growing interest in renewable energy has provided motivation for researchers to perform research in the applicable technologies, such as fuel cell etc. Fuel cell technologies are clean and efficient sources of electricity, and have a wide range of vehicle applications. A fuel cell is an electrochemical energy conversion device which converts the chemicals hydrogen and oxygen into water and in the process produces electricity. Fuel cells are usually classified by the type of electrolyte they use. The Proton Exchange membrane Fuel Cell (PEMFC) or PEFC is commonly used to power a vehicle. In general the fuel cell is considered as a future electrical power source for automotive, portable electronics and stationary applications. Polymer-electrolyte-membrane (PEM) fuel cells are expected to play a key role in forthcoming power-delivering devices. Beside the well known advantages of the low temperature PEM there are some major drawbacks that are directly related to the operating conditions (e.g., 80°C, high gas humidification). So, PEM fuel cells

has its efficiency and economics playing a vital role. In this thesis we are analysing the relationship between the efficiency and economics of the PEMFC[1] .

1.1 Objective

The objective of this thesis can be categorized into 3 part. The main part is to analyze the relationship between the efficiency and economics of PEM fuel cell. Therefore the parameters involved will also be identified.

Furthermore, this project also aims to derive the optimum nominal efficiency produced by the fuel cell in Advance Power Laborator , Faculty Of Electrical Engineering , University Technology Malaysia.

Since the study deals with PEM fuel cell, the working concept of PEM fuel cell be we understood .And the connection between efficiency and economics of the PEM fuel cell will be thoroughly discussed in this thesis.

1.2 Problem Statement

As what said in the introduction, fuel cell generation technology actually has the ability to fulfill the electricity demand and directly combat the problem that the utilities face through transmission of electricity. But the urge to convert to renewable energy is overwhelming these days due to significant depletion

CHAPTER 6

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