Preface

The global energy demand increases every day with increase in population and modernization of the way of life. The intense economic activity around the world depends largely on fossil fuel based primary energy. The indiscriminate use of fossil fuel based energy has inflicted severe damage to air quality, caused water contamination, and environmental pollution in general.

The exploitation of renewable energy sources has been proposed as a solution to encounter the above mentioned global problems. The major problems associated with the exploitation of renewable energy sources are their intermittency, high cost of energy conversion and storage, and low efficiency. In addition, the wide spread utilization of renewable energy leads to the culture of energy saving and rational end use.

Hybrid systems based on different renewable energy sources are becoming more relevant due to the intermittency of single primary energy sources, the increase in the final efficiency in energy conversion in a hybrid system, and the final cost reduction. Moreover, hybrid systems can satisfy the energy demand of a specific application un-interruptedly. There are different types and combinations of hybrid energy systems presently employed around the world. To mention a few, there are photovoltaic-wind energy systems, photovoltaic-thermal energy systems, wind-hydrogen-fuel cell systems, *etc*.

Combined heat and power (CHP) systems have been known for quite some time as a part of hybrid systems. The advantage of this kind of system is its high efficiency, low cost compared to other hybrid systems, and low economic impact without sacrificing continuous energy supply to the load.

This book deals with a new concept in CHP systems where a fuel cell is used for generating electricity and the heat released during the operation of the cell is used for air conditioning needs. For the CHP system considered in this book, we have chosen heat proton exchange membrane fuel cell in particular due to the temperature of the ejected and the air-conditioning needs of the CHP system.

For the authors to have a general understanding of the topic we have treated the energy and co-generation processes in detail. The thermodynamic principles gov-

erning energy conversion in general and fuel cells in particular have been treated briefly. The principles of CHP systems have been explained in detail with particular emphasis on sorption air-conditioning systems.

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