iGP: Smart City

iGP Module: Studying and developing the performance of a micro Gas Turbine

Lead Supervisor: Dr. Ahmed Taher

To ensure sustainable development, adequate and affordable energy should be made available to satisfy the demand of electric energy, which is relevant to the social and economic development of any nation. The distributed micro-generation concept of providing electricity to millions customers distant from the national central grid is becoming more attractive to utilities and municipalities and consequently the market of this technology is growing fast. Therefore, immediate efforts should be made to develop novel generation of high efficient, cost effective energy production systems with minimized environmental impact and emissions to be introduced into the market. In that frame this project is proposed.

The project will use the Brayton power cycle gas turbine to convert the thermal energy produced from various thermal and mainly sustainable energy sources to mechanical energy. In the first phase, see Fig. 1, the combustion chamber will be provided with dual fuel burner, to burn both liquid and gas fuels. Several different sources of thermal energy would be utilized to operate the micro gas turbine including biogas, natural gas, bio-diesel. Meanwhile, reducing the emission will be among the objectives of this project.

This project can be expanded to another phases to maximize the system efficiency. This could be achieved by utilizing the exhaust gas leaving in a heat exchanger to preheat the inlet air or for industrial thermal applications such water desalination. Further reduction action of fuel consumption and improvement of thermal efficiency would also be achieved by utilizing photovoltaic panels to produce electric energy that consumed in splitting water into hydrogen and oxygen by the electrolysis process. The produced hydrogen will be mixed with fuel in the combustion chamber to boost the combustion process. The extension of this project could be the use of solar thermal energy in heating the air delivered by the compressor in a specially designed heat exchanger before entering the combustion chamber in order to minimize the fuel consumption.

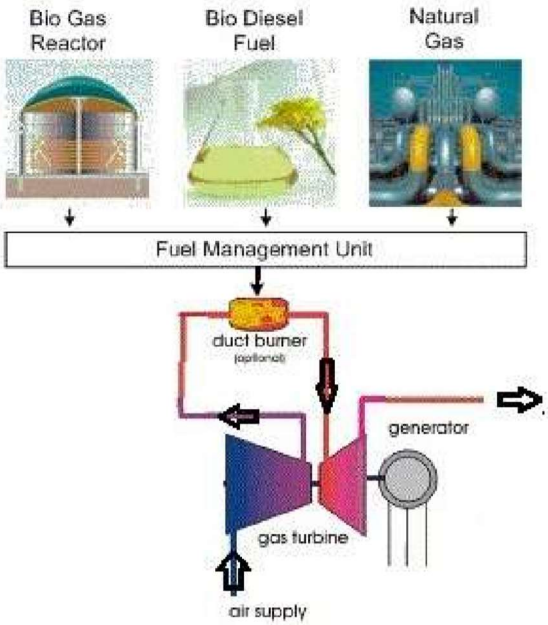

Fig. 1: Micro-Gas-Turbine fueled with both liquid fuel and/or gas fuel.

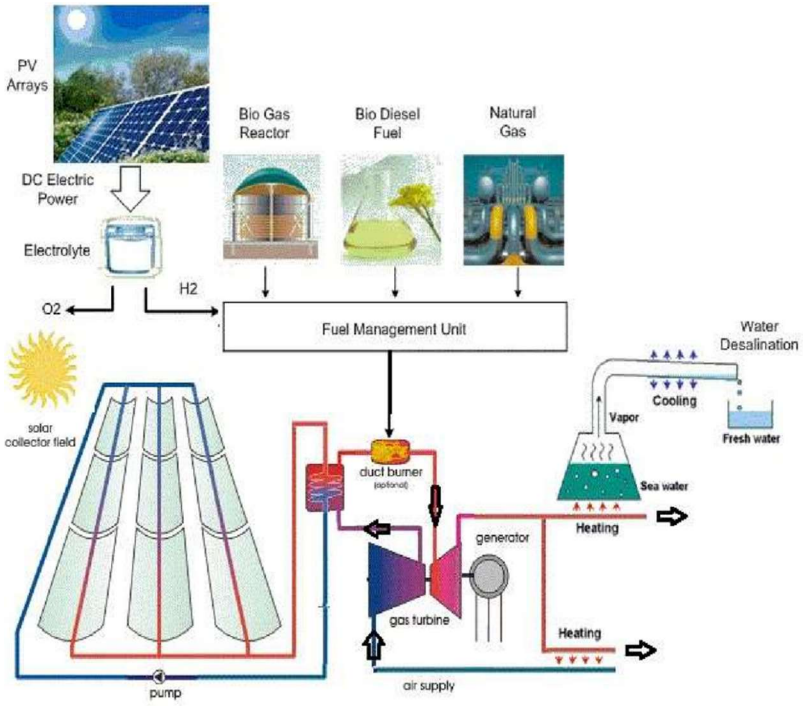

Fig. 2: Project extension to utilize solar energy and to produce fresh water