CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTIONS

When the industrial revolution is starting, people become more and more dependent on hydrocarbon fuels for the generation of power. Now around (85%) of the energy requirements of the almost counties are supplied by fossil fuels. The increasing combustion of fossil fuels and associated carbon dioxide (CO₂) emissions are creating concerns about climate change. One of the most significant and innovative solutions that reduce greenhouse gas emissions and an increase in generated net power with characterized as high efficiency is a combined cycle power plant (CCPP).

Grows energy consumption of the world marketed by (49) percent from (2007 to 2035) (IEO, 2010). The total energy use in the world rises from (495) quadrillions British thermal units (Btu) in (2007) to (590) quadrillions Btu in (2020) and (739) quadrillions Btu in (2035) as shown in Figure 1.1 (IEO, 2010) an increase of over (6%) per annum (Sepehr Sanjay, 2011). The global economic downturn which started in (2007) and non-stop until (2015) has had a profound shock on world energy requirement in the near expression. With the fall in demand among both manufacturers and consumers came a decline in total global marketed energy consumption by (1.2) percent in (2008) and by (2.2) percent in (2009) (IEO, 2010).
The average annual growth in electricity power demand in the world, over the past twenty years, was approximately 6% and forecast for the next five years is 6% per annum (Marroquin, 2010). Furthermore, the rate of electricity consumption was observed to be higher than the rate of production and in particular during the summer season where the high peak of electricity demand prevails.


Due to The combined cycle power plant flexibility in the production of power and relatively inexpensive capital costs, in recent years, it becomes more popular used. This flexibility in the application of combined cycle and improved efficiencies can be achieved. This flexibility is imperative (D. Mahto, 2012). Through the design of the cycle, can operating the gas turbine without operation of the steam turbine. Additionally, parts of the steam that generated from the Heat Recovery Steam Generator (HRSG) can be used for other processes like cooling by vapor absorption
chiller, distillation the sea water and other application, also, to run the steam turbine. Furthermore, by burning additional natural gas in the HRSG can increase the power generation during hours of peak demand. However, the gas and steam turbines have individually efficiencies around (40%), while, and operated together in the combined cycle system, thermal efficiencies can attain 60% of the LHV (D.L. Chase 2000).

The combined cycle power plant (CCPP) combines two thermodynamic cycles, the Rankine cycle for steam turbine and the Brayton cycle for a gas turbine, to generate power efficiently. And these combinations Brayton cycle of the gas turbine and Rankine cycle the steam power system complement each other to form efficient combined-cycles. The Brayton cycle has high source temperature and rejects heat at a temperature that conveniently used as the energy source for the Rankine cycle. In other words, practically in the gas turbine not converted all the energy that come from the combustion of fuel (Natural Gas and Air) to shaft power. The residual energy released as waste heat in the flue gas, the exhaust heat may be used in various ways. If exhaust heat is used to produce steam in a waste heat boiler for a steam turbine, with the object of augmenting the shaft power produced, the system is called combined gas/steam cycle. The only limitation is the exhaust (stack) temperature (Çengel & Boles, 2008)

The most commonly used working fluids for combined cycles are air and steam; other working fluids (organic fluids, potassium vapor, mercury vapor, and others) have been applied on a limited scale. Combined-cycle systems that utilize steam and air working fluids have achieved widespread commercial application (Çengel & Boles, 2008). Usually, in typical plant drive combine one or more than gas turbines, almost