

Introduction

1-1 Introduction

Several gas turbines are being widely used for power generation in several countries all over the world. Obviously, many of these countries have a wide range of climatic conditions, which impact the performance of gas turbines. Problems arise when a gas turbine is used in a geographic location with hot summer. Hot inlet air results in a gas turbine's generating less power, during summer season, when the demand for electricity is higher. In such conditions, power augmentation techniques are highly desirable. Indeed, a little increment of thermal efficiency could result in a significant amount of fuel being saved and a higher level of power being generated. The simplest remedy to this problem is to reduce the temperature of the inlet air. Several different inlet cooling methods are currently employed in various systems.

To meet the growing demand for electrical power utilities have to continuously expand their generation capacities. Not only is the installation of new expensive generation plants, but finding energy sources for these new stations are also a problem. The installation of a new power station also raises more concerns about environmental pollution. The need for installing new power projects can be delayed by enhancing the production capacity of existing power stations, which is very much needed considering the tough challenges facing many countries nowadays. In Sudan, a considerable part of the thermal generation of the Sudan comes from the gas-turbines located at Garri Power Station. Due to high ambient temperature in the area at summer average of 43°C the gas turbines operate at 75% of rate power.

1-2 Problem Statement

- The design power output is 42 MW from the one gas turbine but the actual power is 30 MW to 33MW according to the ambient temperature.
- High fuel Consumption.
- Environmental pollution.

1-3 Objectives

1-3-1 Overall objectives

- To increase output power produced from gas turbine.
- To decrease fuel consumption and environmental impact.

1-3-2 Specific objective

Design & simulation for pre cooler system (vapour compression refrigeration system).

1-4 Methodology

- Literature review.
- Design of pre cooler and simulation of heat exchanger by ANSYS.
- Comparison of the results of evaporative cooler and the chiller cooler
The comparison points are:
 - The power output and the efficiency of the turbine.
 - The heat rate and fuel consumption.
 - The payback period.

1-5 Expected results

- Controlling the air inlet temperature to be maximum at 15 °C all over the year.
- Increasing of the output power.
- Increasing of the efficiency.