5.1. INTRODUCTION

In this chapterthe results were displayedthat obtained from the program for various parameters variability, such as effect of non-linear variable specific heats, effect of intercooler effectiveness (ε), effect of ambient temperature (T_1) and effect of turbine inlet temperature (T_5). Also we will discuss these results and compare with similar results that obtained in previous studies.

5.2. THERMODYNAMIC MODEL INPUT DATA DETAILES

To perform the calculations we assumed the technical and thermodynamic gas power cycle specifications shown in table 5.1

Table 5.1: The technical and thermodynamic engine specifications

Gas cycle arrangement	Two stages compression with intercooler, one stage expansion.
Intercooler pressure (P_i)	$P_i = \sqrt{P_1 P_2}$
Inlet air temperature (T_1)	Vary from 290 K to 360 K with increment 10 K
Turbine inlet temperature (T_5)	Vary from 1500 K to 2000 K with increment 100 K
Total pressure ratio (r_{pt})	Vary from 5 to 30 with increment 1
Intercooler effectiveness (ε)	Vary from 0.5 to 1.0 with increment 0.1
Gas constant for air (R)	0.287 kJ/kg.K
mass flow-rate of air ($\dot{m}_a$)	5 kg/sec
Calorific value of fuel ($C.V.$)	44,000 kJ/kg

Depending on the data above, we will conductthe calculations and presenting the results according to the effect of each parameters mentioned above as shown in the following points.

5.3. EFFECT OF INTERCOOLER EFFECTIVENESS

In this section wediscussed the effect of intercooler effectiveness on the gas cycle performance parameters at fixed ambient temperature.

Show in Fig. 5.1 the relation between the total pressure ratio (r_{p_t}) and the total compressors work (W_c) for 6 different values of intercooler effectiveness.

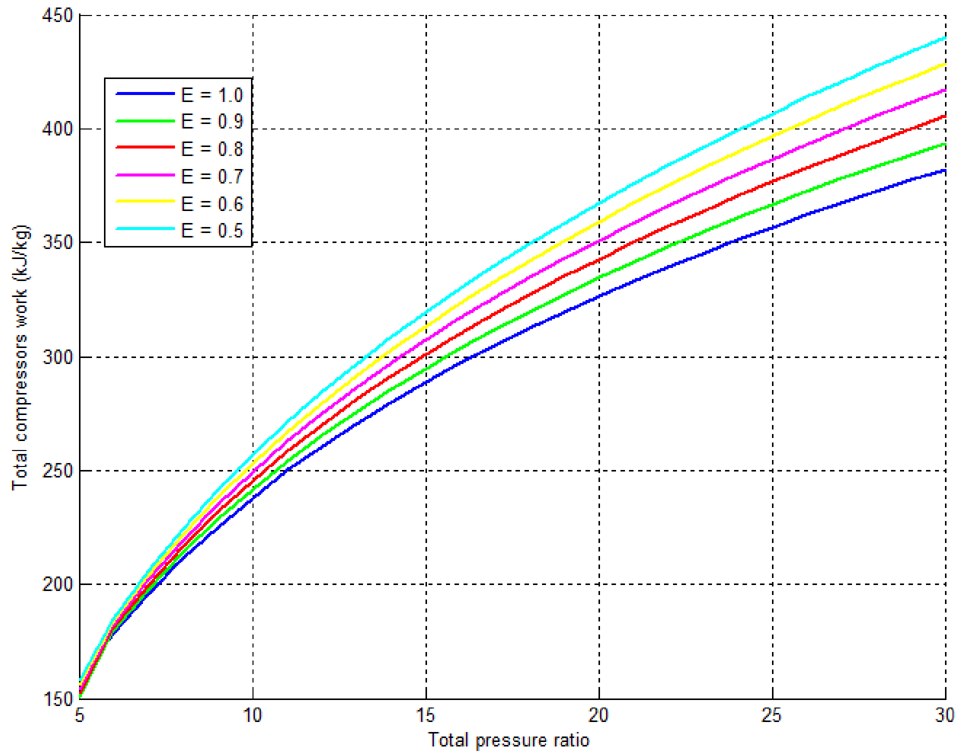

Fig. 5.1: Total pressure ratio (r_{p_t}) versus total compressors work (W_c) with respect of intercooler effectiveness effect

From fig. 5.1 we find that when the intercooler effectivenessincreases, the total compressors work decrease for all values of total pressure ratio.

Also we find the effect of intercooler on the total compressors work is more efficient for higher values of total pressure ratio comparing with total compressors work values corresponding to the lower values of total pressure ratio.

Show in Fig. 5.2 the relation between the total pressure ratio (r_{p_t}) and the thermal efficiency (η_{th}) for 6 different values of intercooler effectiveness.

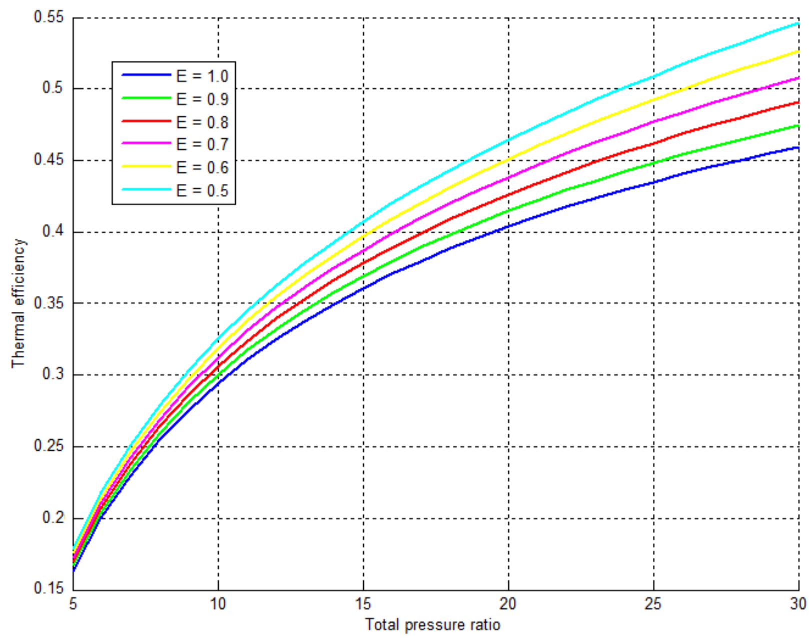

Fig. 5.2: Total pressure ratio (r_{p_t}) versus thermal efficiency (η_{th}) with respect of intercooler effectiveness effect

From fig. 5.2 we find that when the intercooler effectiveness increases, thermal efficiency decrease for all values of total pressure ratio.This decrease in the thermal efficiency due to decreasing in the value of second stage compressor inlet temperature (T_3), which cause decreasing in the combustion chamber inlet temperature (T_4), thereby increase the amount of heat addition respect to constant net output work, this means the thermal efficiency decrease.

Also we find the effect of intercooler on the thermal efficiency decreasing shows significantly in the higher values of total pressure ratio comparing with thermal efficiency values corresponding to the lower values of total pressure ratio.

Show in Fig. 5.3 the relation between the total pressure ratio (r_{p_t}) and the specific fuel consumption ($S.F.C$) for 6 different values of intercooler effectiveness.

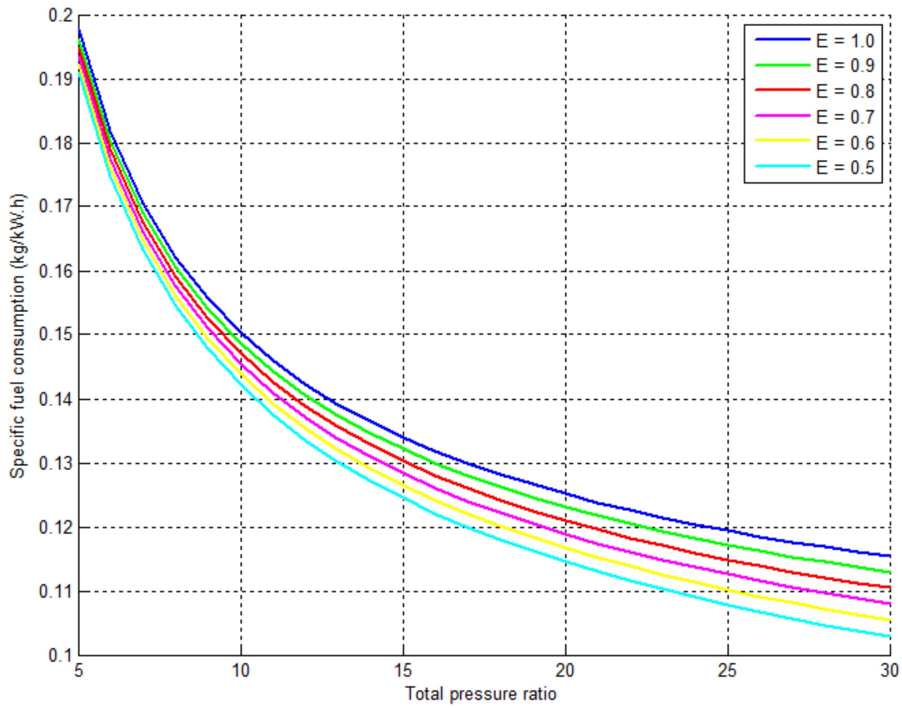

Fig. 5.3: Total pressure ratio (r_{p_t}) versus specific fuel consumption ($S.F.C$) with respect of intercooler effectiveness effect

From fig. 5.3 we find that when the intercooler effectiveness increases, the specific fuel consumption increase for all values of total pressure ratio.Because the increase of intercooler effectiveness cause increase in the amount of heat addition as explained in section 5.2.

Also we find the effect of intercooler on the specific fuel consumption increasing shows significantly in the higher values of total pressure ratio comparing with specific fuel consumption values corresponding to the lower values of total pressure ratio.

5.4. EFFECT OF AMBIENT TEMPERATURE

In this section we discussed the effect of ambient temperature on the gas cycle performance parameters with consideration of perfect intercooling (intercooler effectiveness assumed equal 1.0).

Show in Fig. 5.4 the relation between the total pressure ratio (r_{p_t}) and the total compressors work (W_c) for 7 different values of ambient temperature.

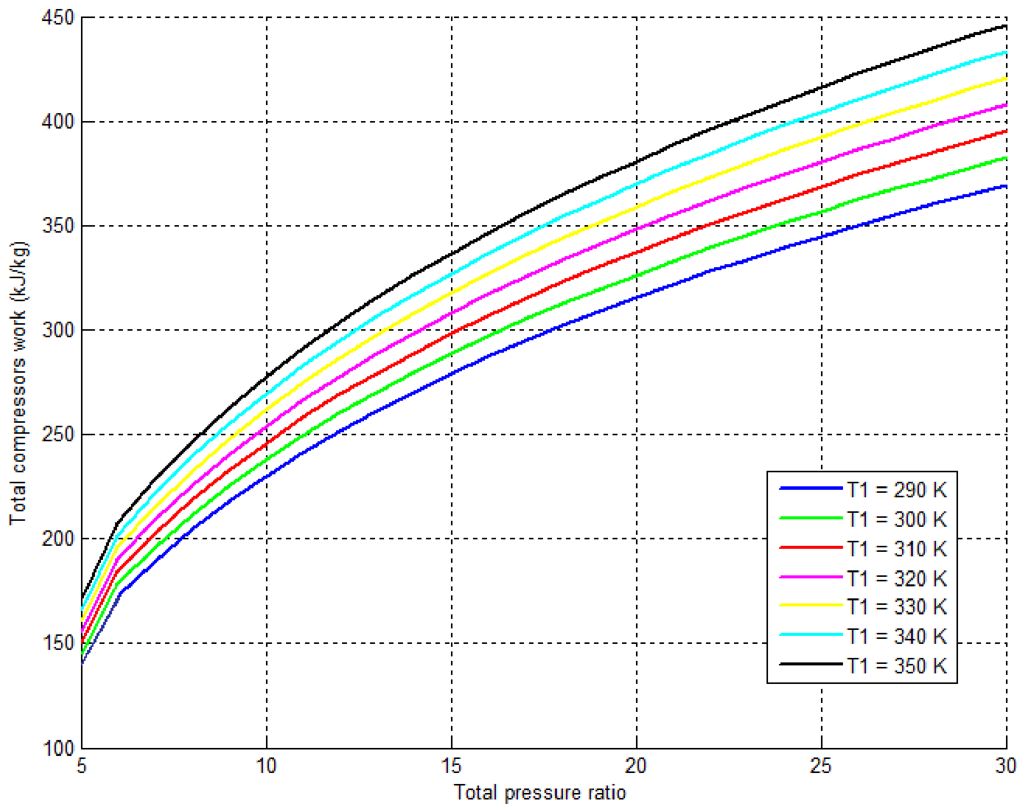

Fig. 5.4: Total pressure ratio (r_{p_t}) versus total compressors work (W_c) with respect of ambient temperature effect

From fig. 5.4 we find that when the ambient temperature increases, the total compressors work increase for all values of total pressure ratio, this variation appears to be small between value for ambient temperatureand another value for ambient temperature that followed.

Show in Fig. 5.5 the relation between the total pressure ratio (r_{p_t}) and the thermal efficiency (η_{th}) for 7 different values of ambient temperature.

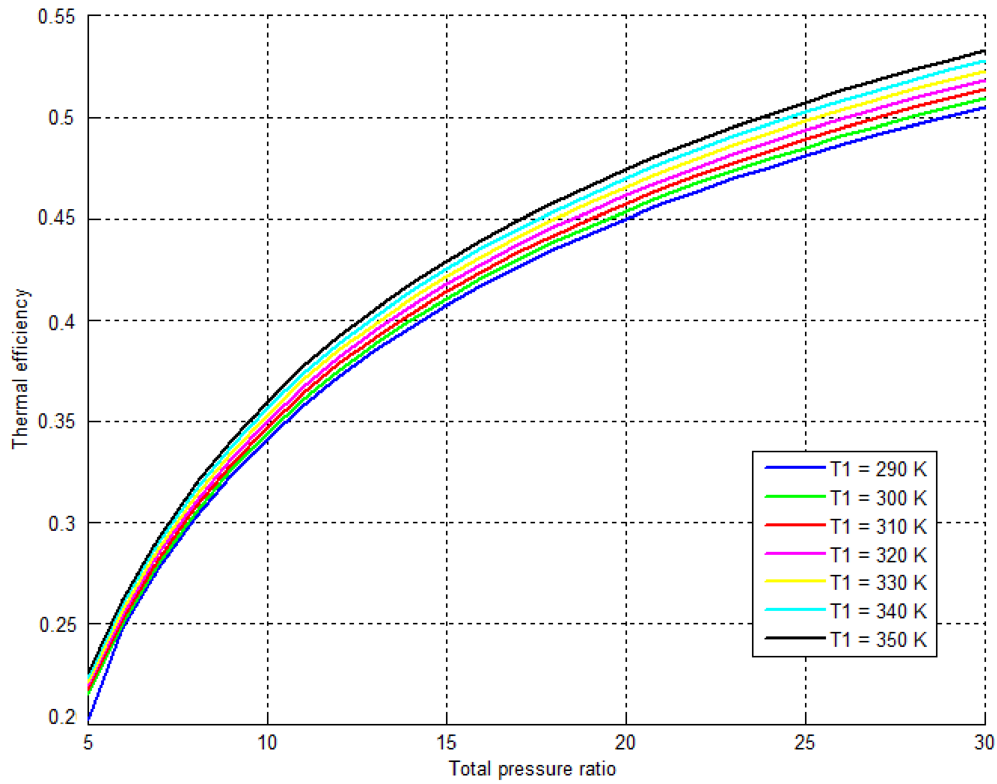

Fig. 5.5: Total pressure ratio (r_{p_t}) versus thermal efficiency (η_{th}) with respect of ambient temperature effect

From fig. 5.5 we find that when the ambient temperature increases, the thermal efficiency increase for all values of total pressure ratio, but the amount of the increase is extremely small.

Show in Fig. 5.6 the relation between the total pressure ratio (r_{p_t}) and the specific fuel consumption ($S.F.C$) for 7 different values of ambient temperature.

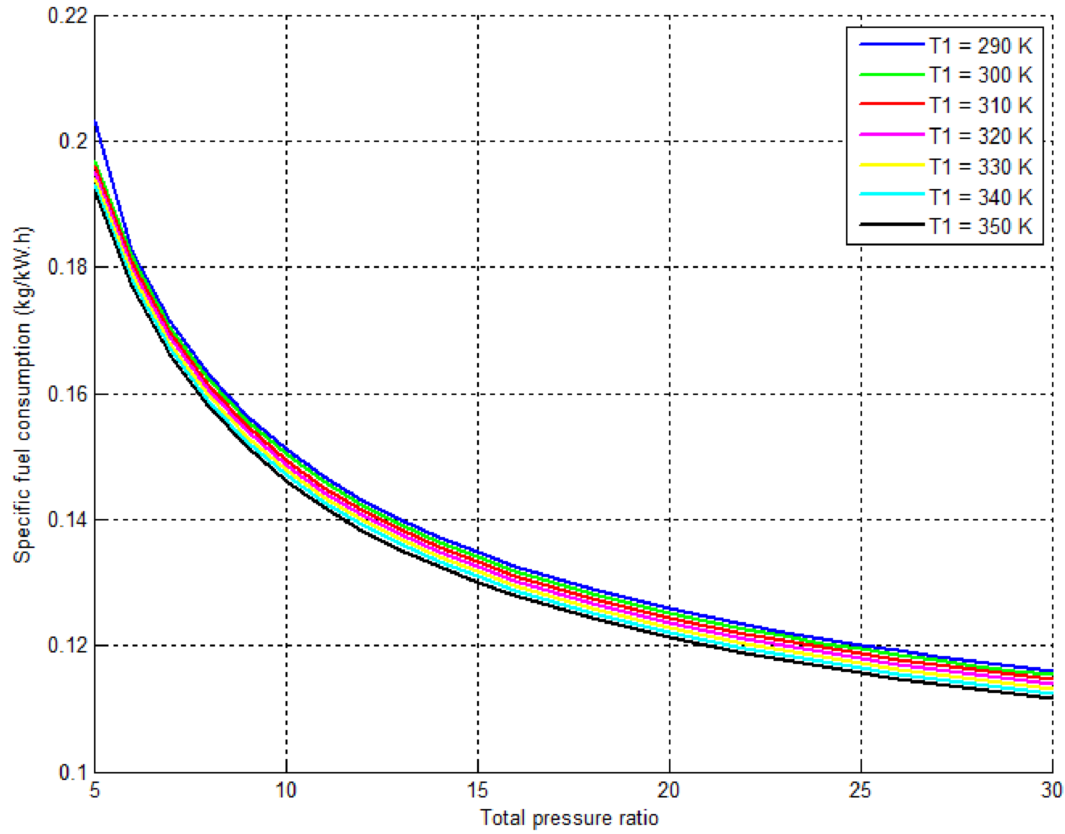

Fig. 5.6: Total pressure ratio (r_{p_t}) versus specific fuel consumption ($S.F.C$) with respect of ambient temperature effect

From fig. 5.6 we find that when the ambient temperature increases, the specific fuel consumption decrease for all values of total pressure ratio, because the net output work increase; but the amount of the increase is extremely small similar to that effect on the thermal efficiency.

5.5. EFFECT OF TURBINE INLET TEMPERATURE

In this section we discussed the effect of turbine inlet temperature on the gas cycle performance parameters with consideration of perfect intercooling (intercooler effectiveness assumed equal 1.0) and fixed ambient temperature.

Turbine inlet temperature variation is not effect on the total compressors work, so there is not a considerable need to plotting the relationship between the total pressure ratio and total compression work.

Show in Fig. 5.7 the relation between the total pressure ratio (r_{p_t}) and the thermal efficiency (η_{th}) for 6 different values of turbine inlet temperature.

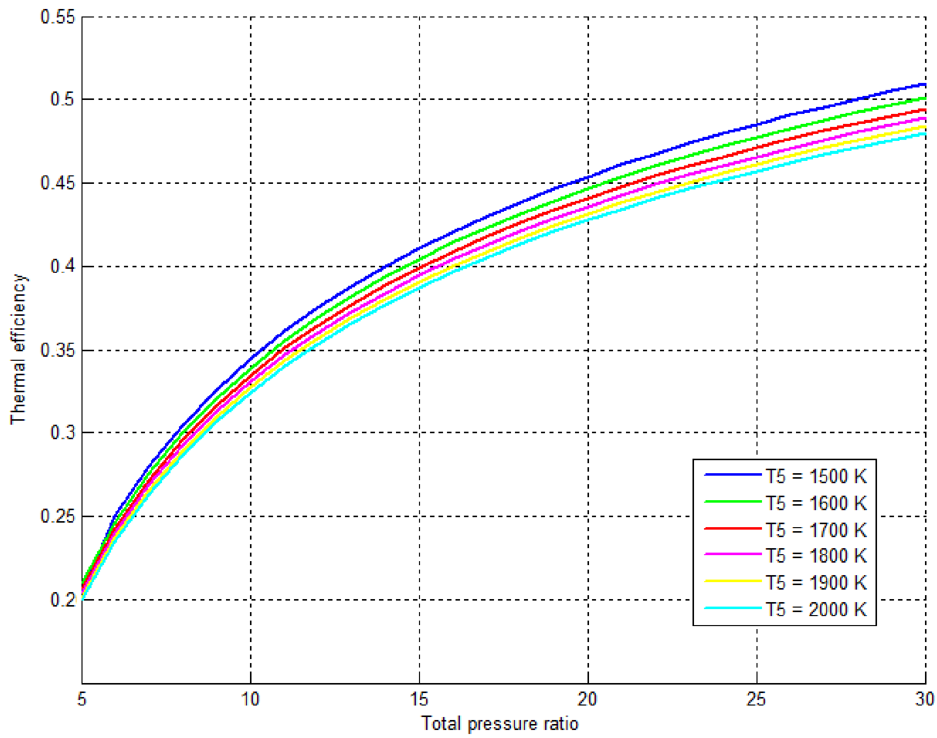

Fig. 5.7: Total pressure ratio (r_{p_t}) versus thermal efficiency (η_{th}) with respect of turbine inlet temperature effect

From fig. 5.7 we find that when the turbine inlet temperature increases, the thermal efficiency increase for all values of total pressure ratio, because the work of turbine increase due to increase of turbine inlet temperature, also as mentioned above the turbine inlet temperature variation does not effect in the total compressors work, thus the thermal efficiency increase, but the amount of the increase in the thermal efficiency is extremely small.

Show in Fig. 5.8 the relation between the total pressure ratio (r_{p_t}) and the specific fuel consumption ($S.F.C$) for 6 different values of turbine inlet temperature.

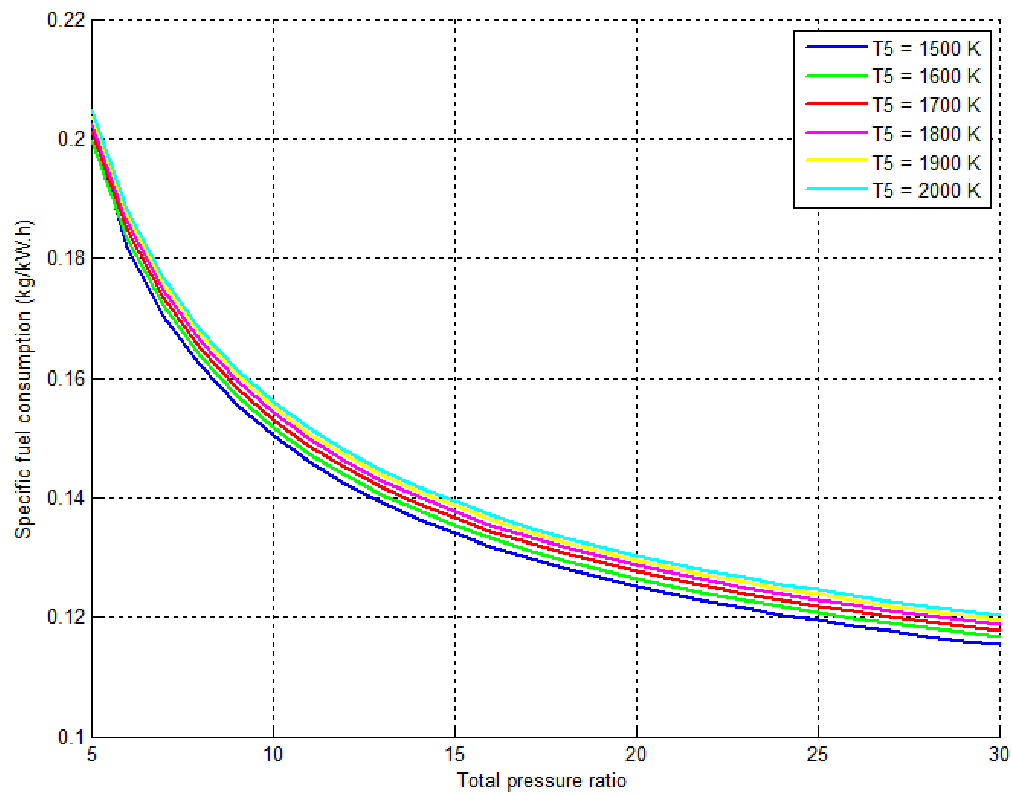

Fig. 5.8: Total pressure ratio (r_{p_t}) versus specific fuel consumption ($S.F.C$) with respect of turbine inlet temperature effect

From fig. 5.8 we find that the effect of turbine inlet temperature variation on the specific fuel consumption is typically similar to that effect caused by the variation of ambient temperature.