

ME 201

Thermodynamics

Homework 16 Due Monday, 3/27/2006

1. Consider a power plant that is producing 1 MW of electric power as it operates with a high temperature of 1800 K and a low temperature of 290 K. If we can sell the electric power for \$0.04 per kW·hr, and the heat transfer from the high temperature reservoir costs \$0.0075 per kW·hr, what is the maximum income per year the plant can generate?
2. It is clear that we can improve the efficiency of a heat engine by lowering the temperature to which the heat rejection occurs. One way to achieve this is to use a refrigerator to produce a low temperature heat reservoir. It is proposed to do this to the power plant of problem #1, lowering the low temperature reservoir to 240 K. If the power plant is still produce 1 MW of electric power, what is the maximum income per year the plant can generate? Remember to include the power requirements of the refrigerator in this calculation. The high temperature heat reservoir for the refrigerator is at 290 K.