Matching Supply with Demand: An Introduction to Operations Management

3rd Edition

Solutions to Chapter Problems

Chapter 18
Sustainability

(last revised March 2012)

Q18.1

a) Total emissions on the journey is 1,400,000 x 38.2 = 53,480,000 kgs CO2. The journey transports 300,000 x 3,000 = 900,000,000 tonne kms. So emissions are 53,480,000 kgs CO2 / 900,000,000 tonne kms = 0.059 kgs CO2 per tonne km.

Q18.2

a) The electricity cost of a 60 watt bulb per hour is \$0.12 per hr x 60 watts per hr / 1000 watts per hr = \$0.0072 per hr. The electricity cost for the LED is \$0.12 per hr x 60 watts per hr / 1000 watts per hr = \$0.00096 per hr. The purchase cost of a 60 watt bulb per hour is \$0.40 / 1000 = \$0.0004 per hr. So the total cost to operate the 60 watt bulb is \$0.0072 + \$0.0004 = \$0.0076 per hr. The total cost to operate an LED for T hours (assuming T < 27,000) is \$12 + \$0.00096 T. The total cost to operate 60 watt light bulbs over T hours is \$0.0076 T. The break even time, T, is then found by solving the following equation \$12 + 0.00096 T = \$0.0076 T. We find that T = 1,807 hours. At 4 hours per day, this is 1807 / 4 = 452 days, which is 452/ 365 = 1.24 years.

b) Total consumption for the 60 watt light bulb per year is 4 x 365 x 60 = 87,600 watt hr. That is 87,600 / 1000 = 87.6 kWh or 87.6 / 1000 = 0.0876 MWh. Emissions is then 450 x 0.0876 = 39.42 kgs CO2 per year.