1. At an industrial plant, it is desired to determine whether one-inch-thick insulation (“option A”) or two-inch-thick insulation (“option B”) should be used to reduce heat loss from a long section of steam pipe. The heat loss from the pipe without any insulation costs $2.00 per linear foot per year. The one-inch insulation will eliminate 88% of the heat loss and will cost $0.60 per foot. Two-inch insulation will eliminate 92% of the heat loss and will cost $1.10 per foot. The steam pipe is 1,000 feet in length and will last for 10 years. MARR = 6% per year. Which insulation thickness should be recommended?

   a. What is the cost to operate the system with no change?
   b. What are the savings for each of “option A” and “option B”? 
   c. What is the simple payback period (SPP) for each option?
   d. Considering the life of the project and the time value of money, compute the AW or PW for each option. Which one do you recommend?

2. An old, heavily used warehouse currently has an incandescent lighting system. The lights run essentially 24 hours per day, 365 days per year, and draw 10 kW (input) of power. Consideration is being given to replacing these lights with fluorescent lights to save on electricity. It is estimated that the same level of lighting can be achieved with 4.5 kW (input) of fluorescent lights. Replacement of the lights will cost about $11,000. Bulb replacement and other maintenance are not expected to be significantly different. Electricity for the lights currently costs $0.045/kWh. The warehouse is scheduled for demolition in five years to make way for a more modern facility. The company has a MARR of 15% per year. Should the company replace the incandescent lights with fluorescent lights? Use the PW method and state any assumptions you make.

   a. What is the operational cost for the current operation, the proposed change, and the potential savings?
   b. What is the SPP?
   c. Considering the time value of money and the life of the project, compute the AW or PW and determine if the proposal is economically justifiable.

3. A company uses a 100hp motor to remove dust from its production area. The motor is approximately fully loaded and runs 18 hrs a day for 5 days each week. Presently, the facility uses standard efficiency motors. The cost of electricity at the plant is $0.06/kWh and the demand charge is $4.50/kW.

   a. How much energy does the present motor use in a year? What is the cost to operate the motor for a year.
   b. Estimate the annual energy and cost savings if the company purchases a premium efficiency motor.

4. A facility has seventeen (17) 400-watt high pressure sodium lamps outdoors that are energized 24 hour/day. It has been suggested that they can save money by turning the lights off during the daylight hours. Assume the lights will be extinguished 10 hours each day and that the electric rates are the same as in problem 3.

   a. What is the current cost of operating the lights?
   b. How much money can be saved by turning the lights out during the day?

5. A plant has 550 400-watt metal halide bulbs in its facility. It has been suggested to replace these with T5HO fluorescent bulbs in a 6-bulb fixture. The lights burn 24x7.

   a. compute the present cost to operate the metal halide lights
   b. compute the cost of operation of the T5HO fixtures and the potential savings
   c. compare the initial lumens, mean lumens, and expected life of these alternatives