Problem 11.4 Electricity Generation and Pollution Control.

The Burtonville Municipal Power Company must produce 2000 megawatt-hours (mwh) of electricity each hour. Air pollution ordinances require it to keep emissions of pollutants below 2800 pounds per hour. (For purposes of this exercise we ignore interesting phenomena like weather and load fluctuation.) The company must decide how to do this at least cost. It can switch to low-sulfur fuel, use stack filters and either high- or low-sulfur fuel, or import power from elsewhere. The relevant characteristics of these options are given in Table 11-4. The company can import only 200 mwh per hour. What should the company do?

Table 11-4

Method	*Results*	*Cost/mwh*
Use present fuel	*Pollution = 10 lbs/mwh*	*$3.50*
Use low-sulfur fuel	*Pollution = 1.2 lbs/mwh*	*$5.00*
Use stack filters	*Pollution reduced by 90%*	*$0.80*
Import power	*No pollution on Burtonville*	*$4.00*

What is the company's objective? To spend the smallest amount generating electricity subject to given constraints.

Let X_A be the number of mwh produced using present fuel with no new filters, X_B the amount using low-sulfur fuel using present fuel with no new filters, X_C the number of mwh produced using present fuel with stack filters, X_D low-sulfur with stack filters, and X_E the amount of imported mwh. Then we have an objective function that looks like this:

$$TOTAL = 3.5X_A + 5X_B + (3.5 + 0.8)X_C + (5 + 0.8)X_D + 4X_E$$

$$2000 = X_A + X_B + X_C + X_D + X_E$$

$$10X_A + 1.2X_B + 1X_C + .12X_D \leq 2800$$

$$X_i \geq 0, \qquad I = A, B, C, D, E$$