Computer Notes on Calculating an Economic Service Life

Perhaps the most tedious aspect of replacement analysis is the calculation of economic service lives. By now you should have a good idea of how to tailor an electronic spreadsheet method to a specific problem, so in this section, we will focus on an Excel screen format that can be used to determine economic service lives. (Here we use the data from Example 15.11.)

Even programming the procedure on the spreadsheet can take a considerable amount of time. Exhibit 1 shows a typical Excel application that can be used to determine the economic service life for the challenger in Example 15.11. On the top portion of the screen, you enter a series of financial data, such as investment, tax rate, current book value, and MARR. In the middle of the screen, you enter other financial data, such as O & M costs, permitted depreciation amounts over the holding period, and market values. From these, you calculate the total depreciation expenses, the book values, taxable gains, gains taxes, and the net after-tax salvage value (column O) as a function of the holding period.

In the lower portion of the screen, you will find the NPW figures on operating costs, depreciation tax credits, and annualized capital cost and operating costs. (Note the sign convention: cost is expressed as a positive number.) In specific, we list

- Holding period (column A): List the holding period of the asset.
- After-tax market value (column B): Copy the after-tax market values that were calculated in column O.
- Present value of market value (column C): List the equivalent present values of the after-tax market values at various holding periods.
- After-tax O & M cost (column D): The before-tax O & M costs in cells B11–B17 are converted into the equivalent after-tax O & M costs.
- Present value of O & M cost (column E): Compute the equivalent present values of the after-tax O & M costs over each holding period.
- Cumulative present value of O & M cost (column F): Here the present value figure for the total operating cost up to the holding period is listed.
- Cumulative present value of depreciation credit (column G): Here the total present value of the depreciation tax credits (savings) up to the holding period is computed. For example, to find the cell entry G28, we first identify the permitted depreciation amounts from cells C14 to F14. Then these amounts are multiplied by the tax rate (say, 40%) to determine the depreciation tax credits. Compute the equivalent present value for these tax credits and sum these amounts to determine the cumulative present value of the depreciation tax credit up to the holding period.
- Total operating cost (column H): This column represents the cumulative present value figures on the total after-tax operating costs obtained by subtracting the depreciation tax credits (column G) from the cumulative present value of the O & M costs (column F).
- Capital recovery cost (column J): To determine the annualized capital recovery cost, first find the net capital cost by subtracting the present value of net salvage
value (column C) from the initial investment (cell I4) at the end of each holding period. Then find the annual equivalent cost by multiplying the net capital cost by the capital recovery factor up to each holding period.

- Equivalent annual operating cost (column K): Find the annualized operating cost: Multiply the cell values in column H by the capital recovery factor up to each holding period.

- Total equivalent annual cost (column L): Sum the cell values of columns J and K.

From the total cost column in L, the minimum cost occurs at the end of year 4, which is the economic service life. The specific cell formulas used to determine the entries at the economic service life (year 4) are shown in the bottom of the screen.

Exhibit 1 Economic service life calculation for Example 15.11 with annotated cell formulas