depending on the purposes of the analysis. For example, we have chosen to use after-tax, net cash flow (estimated cash income) as the numerator in analyzing the dairy investment. This method of calculating ROR indicates to the potential dairy investor the actual "in-pocket" ROR from the investment.

A third method of analyzing the profitability of capital investments is called the **net present value (NPV)** of the investment. This method has the advantage of considering the time value of money, differences in the timing of cash flows for competing investments, and differences in competing projects' size and length of useful life. The general calculation for NPV is given below.

As indicated in the NPV equation, this method considers revenues, expenses, tax savings gained through depreciation (depreciation tax shield), and cost of the initial investment. This net present value calculation reduces each competing investment to its value in terms of **after-tax, present dollars.** The values for NPV may be positive, negative, or equal zero. A negative NPV is telling you that the next best investment alternative, which earns returns at the selected discount rate, is a better investment; therefore, any investment alternative with a negative NPV represents a loss and should not be considered. If competing investments must be reduced to only one choice, the alternative with the highest **positive** NPV will maximize profit.

$$\text{NPV equals sum of } \left[\frac{\text{Each year's tax adjusted revenue}}{\text{Each year's discount factor}}\right]$$

$$\text{minus sum of } \left[\frac{\text{Each year's tax adjusted expenses}}{\text{Each year's discount factor}}\right]$$

$$\text{plus sum of } \left[\frac{\text{Each year's depreciation tax shield}}{\text{Each year's discount factor}}\right]$$

$$\text{minus dollar amount of initial investment}$$

Although NPV is the most sound investment decision criterion, it also has its problems. The two primary problems are the selection of the length of planning horizon and of a legitimate interest rate (discount rate) to be used. The length of planning horizon for a dairy facility is typically 20 years. However, it may be considerably reduced if the entrepreneur considers external forces (e.g., technological change, government policy, market conditions) that increase the risk of the investment. A good rule of thumb for selecting the discount rate would be to use the expected rate of return of an investment alternative of relatively equal size and level of risk. Another problem with NPV, which it shares with all other investment analysis methods, is providing realistic estimates of revenues and expenses. The value of any investment analysis is only as good as the estimates from which it is calculated.

A fourth method of analyzing the profitability of capital investments is called the **internal rate of return (IRR)** of the investment. This method has many of the same advantages as NPV; it considers the time value of money and differences in the timing of cash flows for competing investments. The IRR is defined as the discount rate the dairy investment would have to earn in order for its NPV to equal zero. Thus, if the IRR is greater than the discount rate used in the NPV calculation, the dairy investment is superior to the next best alternative investment. If the IRR is less than the discount rate used in the NPV calculation, the dairy investment is inferior to the next best alternative investment.

Finally, to determine the cash flow feasibility of the project we need to look at the magnitude of the periodic cash flows. The magnitude of these cash flows indicate the ability to meet periodic debt service and other cash operating expense obligations. Additionally, a breakeven analysis gives an indication of how large the primary revenue drivers (herd size, milk sold per cow, and milk price) must be in order to have a breakeven (i.e., zero) net cash flow. For example, a breakeven herd size of 1,350 cows indicates the required number of cows that must be milked at the selected milk sold per cow and milk price to produce a zero net cash flow for the year.

The magnitude of these breakeven points is particularly useful to the potential investor when a yearly net cash flow is negative. In this situation, the magnitude of the breakeven points gives the investor an indication if there is a chance to break even if production or market conditions were to change. For example, if the projected milk price was $15.50/cwt and the breakeven milk price was $15.75/cwt, there might be some justification for optimism on the investor's part that a breakeven cash flow for the year could be generated. A positive fluctuation of 25¢ in the milk price is within the realm of possibility. However, if the breakeven milk price was $19.50/cwt. the investor would have no optimism that an adjustment in milk price would produce a breakeven cash flow for that year.