Module 10: Assessing the Business Case

Learning Objectives

After completing this section, you will be able to:

- Do preliminary assessment of proposed energy management investments.

The measures recommended in the Audit Report need to be assessed in terms of their financial feasibility. While a thorough investment analysis may be beyond the scope of the auditor's mandate, it is important to apply a reasonable amount of rigour to the analysis in support of the recommendations. In this Module, we look at the basic principles of investment analysis and develop sufficient working knowledge that the auditor can apply these principles in the audit report.

10.1 Investment Appraisal

Most organizations have more viable opportunities for investment than they have money to spend. Consequently, they have to decide where and how to invest their money to best advantage.

There is no shortage of material explaining how to apply investment appraisal criteria to energy efficiency measures in buildings. These sources explain the factors that need to be taken into account in any appraisal exercise and spell out the differences between the types of criteria which can be applied to such investments.

The objectives of investment appraisal are:

- to determine which investments make the best use of available money;
- to ensure optimum benefits from any investment made;
- to minimize the risk from making investments;
- to provide a basis for subsequent analysis of the performance of the investment.

Investing in reducing energy consumption is traditionally given a low priority in the financial management of organizations. Many organizations define such investment as a discretionary business maintenance expenditure that is given low priority. This problem is compounded because improving energy efficiency calls for an investment of capital in order to make a future saving in revenue expenditure. So, capital expenditure in one year becomes divorced from revenue gains in another.

In addition, in most organizations, accounting systems focus on records of income and expenditure and the benefits from investing in energy efficiency are simply not visible. Financial records only show outgoings on fuel and energy efficiency measures. They do not measure cost savings from reduced expenditure on energy or other attendant benefits arising from such investment. In these circumstances, the energy efficiency champion needs to take two steps to make the business case:

1. Prepare a detailed investment appraisal for any measure proposed for funding that clearly demonstrates cash savings in subsequent years.
2. Keep accurate records of all costs and benefits arising from energy efficiency measures.

10.2 Investment Criteria

In most respects, investment in energy efficiency is no different from any other area of financial management. So when your organization first decides to invest in increasing its energy efficiency it should apply exactly the same criteria to reducing its energy consumption as it applies to all its other investments. It should not require a faster or slower rate of return on investment in energy efficiency than is demanded elsewhere.

The basic criteria used for financial investment appraisal include:

- **Simple Payback** – a measure of how long it will be before the investment makes money, and how long the financing term needs to be;
- **Return on Investment (ROI) and Internal Rate of Return (IRR)** – measures that allow comparison with other investment options;
- **Net Present Value (NPV) and Cash Flow** – measures that allow financial planning of the project and provide the company with all the information needed to incorporate energy efficiency projects into the corporate financial system

10.2.1 Simple Payback

Simple payback is a quick way of evaluating an investment in terms of how long it will take to recover the capital investment cost of the measure as a result of savings or improvement in cash flow. It is expressed as:

$$SPP\ (years) = \frac{Capital\,Cost}{Annual\,Savings}$$

Obviously a shorter payback generally indicates a more attractive investment.

Simple Payback would not normally be used as the basis for investment decisions; it is a “quick and dirty”, preliminary indicator of the possible merits of an investment.

It does not take into account the cost of money, which may be an important concern.

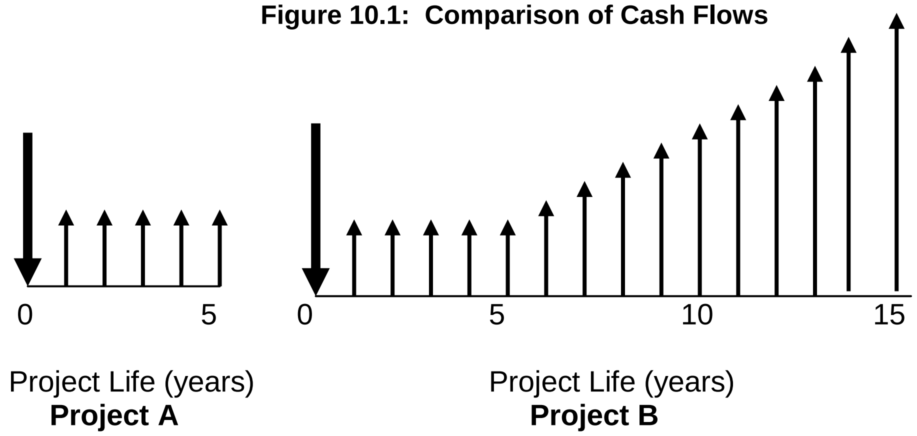
It also does not take into account anything that happens after the payback period. For example, a project could pay back in one year, but then not continue to achieve those savings accrued in that first year; the payback period would be an attractive one year, but a more detailed analysis would show that it is not a good investment.

10.2.2 Cash Flow and Net Project Value

Figure 10.1 illustrates this point by comparing two cash flow scenarios for the same initial cost. Clearly Project B is the more attractive investment because of its total return over time, even if the initial cost were recovered in the same period for Project A.

The cash flow diagram shown in Figure 10.1 is a simple but very useful tool for financial analysis. It shows, for example, that an investment may have a five year payback, as in Project A, but if the life of the investment is 15 years total, as in Project B, it may provide significantly greater benefit than at first appears to be the case.

Figure 10.1: Comparison of Cash Flows



The diagram is a graphical representation of:

- The time line, typically in years;
- Costs incurred, including the initial capital investment, as well as subsequent costs related to the project (maintenance expenditures, for example)—shown as downward pointing arrows;
- Positive cash flow such as savings, shown as upward pointing arrows.

The same information can be presented more quantitatively in tabular form, as the following example illustrates:

Table 10.1: Cash Flow Table for Purchase of new Boiler						
Capital Expenditure R100,000	90% on delivery/commissioning, and 10% performance guarantee due at one year.					
Expected Savings R48,000	Half in first year, full amount in all remaining years.					
(Values in R'000)						
Year	**0**	**1**	**2**	**3**	**4**	**5**
Costs	(90.0)	(10.0)	0	0	0	0
Savings	0	24.0	48.0	48.0	48.0	48.0
Net cash flow	(90.0)	14.0	48.0	48.0	48.0	48.0
Net Project Value	(90.0)	(76.0)	(28.0)	20.0	68.0	116.0

In this table, in addition to calculating the net cash flow each year (that is, the savings less the costs for that year), we have calculated the cumulative net cash flow or net project value.

This analysis shows that the simple payback period is between two and three years, a conclusion we could quickly reach by dividing R100,000 by R48,000. More importantly, it shows that the value of the investment continues to grow with each subsequent year of savings. The table can also accommodate those other costs referred to in reference to the cash flow diagram, such that a considerably more complex analysis can be done.

Worksheet 10.1: Cash Flow Analysis						
Capital Expenditure R Expected Annual Savings R			Details:			
(Values in R'000)						
Year	**0**	**1**	**2**	**3**	**4**	**5**
Costs						
Savings						
Net cash flow						
Net Project Value						

In these examples, there have been only two kinds of cash flow: the initial investment as one or more installments, and the savings arising from the investment. This oversimplifies the reality of energy management investments, of course.

There are usually other cash flows related to a project. These include the following:

- **Capital costs** are the costs associated with the design, planning, installation and commissioning of the project; these are usually one-time costs unaffected by inflation or discount rate factors, although, as in the example, installments paid over a period of time will have time costs associated with them.

- **Annual cash flows**, such as annual savings accruing from a project, occur each year over the life of the project; these include taxes, insurance, equipment leases, energy costs, servicing, maintenance, operating labour, and so on. Increases in any of these costs represent negative cash flows (the downward arrow in Figure 10.1), whereas decreases in the costs represent positive cash flows (upward arrows).

  Factors that need to be considered in calculating annual cash flows are:

- **Taxes**, using the marginal tax rate applied to positive (i.e. increasing taxes) or negative (i.e. decreasing taxes) cash flows

- **Asset depreciation**, the depreciation of plant assets over their life; depreciation is a "paper expense allocation" rather than a real cash flow, and therefore is not included directly in the life cycle cost. However, depreciation is "real expense" in terms of tax calculations, and therefore does have an impact on the tax calculation noted above. For example, if a R100,000 asset is depreciated at 20% and the marginal tax rate is 40%, the depreciation would be R20,000 and the tax cash flow would be R8,000—and it is this latter amount that would show up in the costing calculation.

- **Intermittent cash flows** occur sporadically rather than annually during the life of the project; relining a boiler once every five years would be an example.

10.2.3 Return on Investment (ROI)

ROI is a broad indicator of the annual return expected from the initial capital investment, expressed as a %:

$$ROI \;=\; \frac{Annual\,Net\,Cash\,Flow}{Capital\,Cost} \times 100$$

The ROI must always be higher than the cost of money and, in comparison with other projects, a greater ROI indicates a better investment. Once again, however, ROI does not take into account the time value of money or a variable annual net cash flow.

10.3 Life Cycle Costing

10.3.1 Net Present Value (NPV)

The critical factor that is omitted from the simple financial indicators is the **time value of money**, the fact that interest applies to any invested funds. Obviously R1,000 today is more valuable than R1,000 a year from now because of the interest that the first amount will accumulate over that year.

Therefore, in evaluating energy management investments, we need to consider the **Present Value (PV)** and the **Future Value (FV)** of money. The two are related very simply by:

$$FV \;=\; PV\ x\,(1+i)^n \quad \text{or} \quad PV \;=\; \frac{FV}{(1+i)^n}$$

where:
FV = future value of the cash flow
PV = present value of the cash flow
i = interest or discount rate
n = number of years into the future

In NPV and IRR appraisals, instead of calculating the net present value of a project, we need to calculate the discounted net present value to put future savings into present value terms based on the existing interest or discount rate.

Fortunately, in doing so, it is not necessary to calculate the power series in the PV/FV equations directly. Tables of discount factors are commonly available, and spreadsheet applications such as Excel do the calculation for you.

To understand the process, however, let’s look at a manual discounted net present value calculation. An excerpt from a discount factor table is given in Table 10.2.

Table 10.2: Discount Factors $1/(1 + i)^n$						
Year (n)	0	1	2	3	4	5
Discount Factor						
6%	1	0.942	0.888	0.840	0.792	0.747
10%	1	0.909	0.826	0.751	0.683	0.620
20%	1	0.833	0.694	0.579	0.482	0.402
30%	1	0.769	0.591	0.456	0.350	0.270
40%	1	0.714	0.510	0.364	0.260	0.186
45%	1	0.690	0.476	0.328	0.226	0.156
50%	1	0.666	0.444	0.297	0.198	0.132

If we recalculate the example of Table 10.1, now applying discounting to the cash flow, the discounted net cash flow, or the Net Present Value (NPV) of the project is determined as in Table 10.3. (Following usual accounting practice, values in parentheses are negative; the normal practice is to indicate costs as negative, and benefits such as savings as positive in this kind of analysis.)

Table 10.3: NPV Calculation						
Year	0	1	2	3	4	5
Net cash flow (R000s)	(90.0)	14.0	48.0	48.0	48.0	48.0
The discounted cash flow at 10% can be found as follows:						
Year 0	1 x (90.0)	= (90.0)				
Year 1	0.909 x 14.0	= 12.73				
Year 2	0.826 x 48.0	= 39.65				
Year 3	0.751 x 48.0	= 36.05				
Year 4	0.683 x 48.0	= 32.78				
Year 5	0.620 x 48.0	= 29.76				
NPV = the sum of all these values = 60.97 (compare to net project value = 116.0)						

The discount rate that is applied in this calculation represents not only the prevailing interest rate, but also some factor to cover handling costs of money, often around 5%. That is, as a matter of policy, an organization might choose to use a discount factor of, say, the national bank interest rate plus 5% (or some other appropriate factor that deals with handling and perhaps risk).

10.3.2 Internal Rate of Return (IRR)

If this NPV calculation were repeated for different discount rates, we would find that the higher the discount rate, the lower the NPV, eventually becoming negative. It follows that there is a discount rate for which the NPV = 0; this discount rate is defined as the Internal Rate of Return (IRR). Finding the IRR manually involves an iterative process where the NPV is calculated for various discount factors, with NPV plotted against discount rate to generate a curve that crosses the x-axis (that is, at NPV = 0), thereby giving the IRR.

For many organizations, the decision on whether or not to implement a given investment is based on the IRR compared to company expectations or policy. That is, if the IRR is equal to or greater than the criterion value, the investment might be considered feasible.

Worksheet 10.2: Discounting						
Year	**0**	**1**	**2**	**3**	**4**	**5**
Net cash flow (R000s)						
Discount Rate: %						

	Discount Factor	**X Net Cash Flow**	**= Discounted Cash Flow**
Year 0 Year 1 Year 2 Year 3 Year 4 Year 5			
		NPV = sum of Discounted Cash Flows =	

10.3.3 Spreadsheet Applications for NPV and IRR

Fortunately, it is no longer necessary to do NPV or IRR calculations manually, as most spreadsheet programs include this utility. Excel, for example, allows you to input a range of cash flow values, along with the discount factor to be applied, to calculate the NPV.

When the example of Table 10.3 is entered into an Excel spreadsheet, and the NPV function is selected, followed by the IRR function, the following table is generated:

Table 10.4: Internal Rate of Return

year	net cash flow	Discount	NPV	IRR
0	-90000	10%	R61,048.67	30.37%
1	14000	20%	R25,216.05	
2	48000	25%	R11,885.44	
3	48000	30%	R753.50	
4	48000	31%	-R1,250.47	
5	48000	35%	-R8,627.04	

Note that the NPV for a discount factor of 10% differs slightly from that calculated manually. Not only is the spreadsheet calculation considerably easier, but more decimal places can be carried for the discount factor resulting in a more precise result.

10.4 Risk and Sensitivity Analysis

The last issue to be addressed in this costing summary is the evaluation of risk. In projecting cash flows several years out, we encounter many uncertainties. For example, the fuel savings arising from a boiler retrofit are based on quantity of fuel consumed—and this can be reasonably predicted—as well as the price of fuel. What happens to the feasibility of the project if today's fuel price goes up, or down?

Even without getting into sophisticated risk analysis techniques, the energy manager should at least consider the impact of changes from current conditions in price of energy, interest rate, or any other factor that is subject to change. It is useful to at least examine a **pessimistic** and an **optimistic** forecast in addition to the **realistic** one on which you would want to base your decision.

The question is, what is the impact on the NPV and/or the IRR of the pessimistic and optimistic forecasts? If the impact is large, we would say that the project is sensitive to changes of the kind being examined, and therefore, the risk of the project not realizing investment objectives is high. Conversely, if the impact is small, the risk too is small and we would have rather more confidence in moving forward with the project.

“What if” risk analyses can be readily done in spreadsheet applications in which values of selected input variables are entered into the calculation to generate resulting NPVs or IRRs.