Module 8: Developing the Business Case

Module 8 develops a practical knowledge of financial analysis of proposed energy management measures, and the concepts and language that the energy manager needs in order to make the business case for those measures. Especially relevant to energy management projects in South Africa, the Module includes an introduction to the Clean Development Mechanism as a means of improving the business merits of projects.

Module 8 Learning Objectives:

After completing this module, you will be able to:

- Establish the business case for energy management investments
- Calculate the simple payback and return on investment of a proposed project
- Identify costs and cash flows that need to be included in life cycle costing
- Use discount factors to determine net present value and internal rate of return for a project
- Propose alternative strategies for financing projects
- Consider the use of energy performance contracting as a means to procure turn-key implementation of projects
- Assess the opportunity for and value proposition of generating a cash stream from employing the clean development mechanism (CDM)

8.1 Introduction

This Module provides the tools and techniques for building the business case for energy management investments. There will come a time in the energy management process when investment will be required

- for process improvements, new equipment, building renovations
- to provide staff training
- to implement or upgrade the energy information system
- and other priorities.

There are two issues organisations have to give attention to when considering whether to make energy management investments:

- **internal** - their effect on their in-house operations
- **external** - their impact on relationships with clients and communities.

To establish the business case for investment in energy management, you need to able to demonstrate:

- the nature and size of the energy problem and opportunity it currently faces
- the full range of capital, O&M and training measures available to address the problem and opportunity
- the predicted return on any investment
- the real returns achieved on particular measures over time.

8.2 Building the Business Case

Sound investments in energy management are not made in isolation from the other business processes that have been discussed in the previous modules. Some investments are made to develop organisational capacity for energy management, and others are made to implement specific improvements.

Whatever their purpose, it is crucial that energy management investments be managed through the same business processes that apply to other investment priorities.

The business case for energy management investments is built by means of the following steps:

1. Assess the current or baseline situation (Section 8.3)

2. Identify and prioritise possible energy management measures (Section 8.4)

3. Analyse the costs and benefits of the proposed investments and present them in appropriate financial terms to facilitate the decision for implementation (Section 8.5)

4. Select the financing and implementation mechanism that provides the strongest business case (Section 8.6).

8.3 Assessing the baseline situation

Energy management investments have to be seen as additions to, not as substitutes for, having effective management practices for controlling energy consumption throughout the organisation. Spending money on technical improvements during Phase 2 of your programme of energy management cannot compensate for inadequate attention to gaining control over energy consumption during Phase 1. So, in addition to planning investments, it is important to ensure that:

- you are getting the best performance from existing plant and equipment
- energy tariffs and purchase agreements have been optimized
- the most cost-effective energy sources (fuels, electricity, renewable energy, etc.) are being utilised
- operations and maintenance practices are carried out in such a way that energy performance is optimized.

The timing of technical improvements can also be critical to their financial viability and acceptance. For example, there may be a more favourable case to installing process improvements when essential maintenance work is being undertaken on existing facilities, or when production capacity is being increased. At such times the marginal cost of improving energy efficiency can be very low. Energy management priorities should be inputs to any new design work and major maintenance so that opportunities for increased energy efficiency are not lost. Even with routine maintenance, opportunities to install more efficient and cost-effective technology should be exploited. In many organisations, the energy policy sets energy efficiency as a criterion for the procurement of new equipment.

8.4 Identifying and Prioritising Opportunities

The most common approach to deciding when and where to invest in energy management is to first assess the facilities, departments and processes that have the largest energy expenditure. This has an obvious advantage: proportionately larger savings can be made from big bills than from smaller ones. This can be a good tactic if your immediate need is to show that energy management activities provide value for money.

The identification of possible measures typically involves internal assessment that is part of the organisation's normal management processes, and/or process and facility audits conducted by external energy professionals. (The 7 Steps approach to energy assessment summarised in Module 9 is a method for internal assessment.)

8.4.1 Setting priorities

The priority of possible measures will be based on the relative costs for implementation in comparison to the projected benefits.

All costs, both direct and indirect, need to be included in the analysis. Over and above the obvious cost of a technological retrofit, there may be additional costs associated with maintenance and other issues. As a checklist, be sure that the following costs are considered:

- ♦ direct project costs
- ♦ new maintenance costs
- ♦ cost of operational adjustments (additional staffing perhaps, or different production rates, etc.)
- ♦ training of personnel on new technology or operations.

Similarly it is important to include direct and indirect benefits in financial terms; they may include:

- ♦ energy savings
- ♦ water savings
- ♦ maintenance savings
- ♦ increased productivity
- ♦ improved product quality

as well as some non-financial benefits such as:

- ♦ improved workplace environment
- ♦ mitigation of external environmental impact.

In addition to the cost/benefit analysis, investment opportunities should be assessed in light of the following factors:

- ♦ the energy consumption per unit of production of a plant or process
- ♦ the current state of repair and energy efficiency of the , plant and services, including controls
- ♦ the residual value or life of existing plant and equipment
- ♦ the effect of any proposed measure on staff attitudes and behaviour.

All of these factors need to be considered in the prioritisation of investment opportunities. For instance, if priority is given to funding technical measures in plants with the largest energy bills, without regard to improving the worst environmental conditions, then you may fail to gain the support of plant personnel who are subject to those conditions.

Bear in mind that, in the longer run, investments which alienate members of staff may cost you and your organisation more—in reduced productivity, in lost good housekeeping practices, misused controls or abused maintenance—than you can expect to save from the measures concerned.

8.5 How to Analyse the Investment

Most organisations have more viable opportunities for investment than they have money to spend. Therefore, 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 which 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, ranging from simple 'payback' calculations through to 'life-cycle' costing. 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 minimise 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 organisations. Many organisations define such investment as a discretionary business maintenance expenditure which 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 organisations, 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 expenditures 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, you need to take two steps to make your case:

- take particular care to prepare a detailed investment appraisal for any measure which you wish to see funded which clearly demonstrates cash savings in subsequent years

- keep your own accurate records of all costs and benefits arising from energy efficiency measures since no one else is likely to compile information to support your activities.

8.5.1 Investment criteria

In most respects, investment in energy efficiency is no different from any other area of financial management. So when your organisation 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 it demands elsewhere.

Initially, when you can identify no or low cost investment opportunities, this principle should not be difficult to maintain. However, if your organisation decides to fund a rolling programme of such investments, then over time it will become increasingly difficult for you to identify opportunities which conform to the principle. Before you reach this position, you need to renegotiate the basis on which investment decisions are made.

The investment criteria that are commonly used include:

- simple payback period - for the rough prioritisation of alternative measures

- cash flow analysis and return on investment
- life cycle costing methods, such as . Discounted Cash Flow, Internal Rate of Return and Net Present Value.

8.5.2 Simple Payback Period (SPP)

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

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

Obviously a shorter payback generally indicates a more attractive investment.

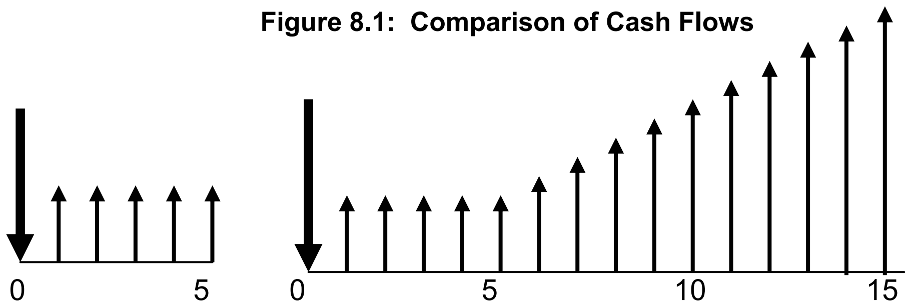
Simple Payback would not normally be used as the basis for investment decisions; it is a “quick and dirty”, preliminary indicator of the possible merits of an investment.

It does not take into account the cost of money, which in Brazil, remains 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.

Figure 8.1 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.

Figure 8.1: Comparison of Cash Flows



Project Life (years)
Project A

Project Life (years)
Project B

The cash flow diagram shown in Figure 8.1 is a simple but very useful tool for financial analysis. The diagram is a graphical representation

- 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 8.1: 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/year			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 100,000 by 48,000. 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.

Note again, however, that this analysis does not take into account the time value of money, which is discussed in reference to life cycle costing in section 8.2.3.

8.5.3 Cash Flows

In these examples, there have been only two kinds of cash flow: the initial investment as one or more instalments, 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, instalments 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 8.1), 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 R1,000 asset is depreciated at 20% and the marginal tax rate is 40%, the depreciation would

be R200 and the tax cash flow would be R80—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.

8.5.4 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.

8.5.5 Life Cycle Costing – Net Present Value and Internal Rate of Return

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. So, obviously, 100 Rand today is more valuable than 100 Rand 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 life cycle costing, 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 8.2.

Table 8.2: 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 8.1, 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 8.3.

Table 8.3: NPV Calculation						
Year	0	1	2	3	4	5
Net cash flow (R$000s)	(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 organisation 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).

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 organisations, the decision on whether or not to implement a given investment is based on the IRR compared to company expectations or policy—the "hurdle rate". That is, if the IRR is equal to or greater than the hurdle rate, the investment is feasible.

8.5.5.1 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 8.3 is entered into an Excel spreadsheet, and the NPV function is selected, followed by the IRR function, the following table is generated:

Table 8.4: NPV and IRR Calculations in Excel

Year	net cash flow	discount rate	NPV	IRR
0	-90000	10	R61,048.67	30%
1	14000	20	R25,216.05	
2	48000	25	R11,885.44	
3	48000	30	R753.50	
4	48000	35	-R8,627.04	
5	48000			

8.5.5.2 IRR and Simple Payback
Table 8.5 draws a useful connection between simple payback and internal rate of return for a range of project terms (for example, the projected service life of equipment). The point to be taken from it is that energy efficiency measures can yield very attractive investment opportunities when evaluated on the basis of corporate investment policy.

Table 8.5: Internal Rate of Return vs. Simple Payback

Project Life (years)

Simple Payback (years)	***1***	***2***	***3***	***4***	***5***	***10***	***15***
1	*0%*	*62%*	*84%*	*93%*	*97%*	*100%*	*100%*
2		*0%*	*23%*	*35%*	*41%*	*49%*	*50%*
3			*0%*	*13%*	*20%*	*31%*	*33%*
4				*0%*	*8%*	*21%*	*24%*
5					*0%*	*15%*	*18%*
6						*11%*	*15%*
7						*7%*	*12%*
8						*4%*	*9%*
9						*2%*	*7%*
10						*0%*	*6%*

8.5.6 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 of the pessimistic and optimistic forecasts on the NPV and/or the IRR. 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.

8.6 Financing of Energy Management

Energy management needs to be, and can be, financially sustainable. The financing of energy management is usually discussed simply in terms of the number of staff or the money available for technical measures to save energy. But, in the first instance, it is important to consider the whole issue of how to finance energy management at a more basic level than this and ask two fundamental questions which are too frequently ignored:

- where, over both the short and long term, are the funds to support energy management to come from?
- where, in both the short and long run, will the savings go?

Unless these simple questions can be successfully answered, then however sophisticated your energy management activities become, they are likely to remain financially unstable. Either they will run the risk of operating on a financial basis that, sooner or later, becomes self-limiting, or if they survive, it will be in circumstances where their continued existence is always vulnerable to changes in priorities which are decided elsewhere within your organisation.

8.6.1 Key decisions

There are two essential decisions which your organisation needs to make about its involvement in energy management:

- is it to be conducted by in-house staff or brought in from outside?
- is it intended to be a time-limited project or a permanent function?

The answers to these questions may vary over time. For example, an organisation might start with energy management being staffed solely in-house and then, in the longer term, move to employing an external energy management contractor to carry out specific tasks. Or, it may begin by employing external consultants (for example, to carry out energy audits, or set up and commission its M&T system) and then use in-house staff to run and maintain it.

Where energy management is delivered by external consultants or energy management contractors, then it can be paid for, as and when required, like any other service - whether on a fee basis or through allocating a percentage of the savings made.

Because of its continuous and phased nature, it is not sensible to treat energy management as a time-limited project. It can only really be effective as a permanent function. However, there are specific energy management activities, such as the installation of new process technology, the implementation of an information system, or the provision of training programmes, which can be successfully treated as projects.

8.6.2 Internal financing options

There are four options for financing in-house energy management:

1. from a central budget
2. from a specific departmental or section budget, such as building sources or engineering
3. through payment for services by individual budget holders, or
4. by retaining a proportion of the savings achieved.

All of these methods for financing energy management are workable, at least in the short term. Alternatively an organisation can use a combination of options, for example, part central funding and part payment for services rendered.
Whichever internal financing strategy is chosen, it is necessary to decide what happens to the savings resulting from energy management activities. Such savings can be fed in or out of an organisation at four different levels:

1. paid out as a dividend to staff or shareholders
2. absorbed into the central budget
3. retained by department, section or facilities budget holders, or
4. returned to the energy management budget.

If all of the revenue savings arising from energy management activities are distributed as dividends or go to other budget holders, then energy management cannot become self-financing.

One way to make energy management self-financing is to split revenue savings to provide identifiable returns to each interested party. This has the following benefits.

- Assigning a proportion of energy savings to your energy management budget means you have a direct financial incentive to identify and quantify savings arising from your own activities.

- Separately identified returns will help the constituent parts of your organisation understand whether they are each getting good value for money through their support for energy management.

- If operated successfully, splitting the savings will improve motivation and commitment to energy management throughout the organisation since staff at all levels will see a financial return for their effort or support.

- But the main benefit is on the independence and sustainability of the energy management function as it moves into the “maintenance” strategic phase.

8.6.2.1 How much financing?
Whatever your organisation sees as the primary purpose of energy management and however it chooses to finance such activities, the total sum allocated will depend on the level of investment required to:

- improve the energy efficiency of your facilities, plant and equipment
- meet staff energy-related training and awareness needs
- upgrade the energy information system
- provide the human resources needed to carry out these activities.

8.6.3 External Financing Options

External financing can be obtained for energy management investments as for any other corporate investments. However, in addition to loans and leases provided by

vendors and financial institutions, there are two mechanisms that are specific to energy management:

- energy performance contracting (EPC) provided by energy service companies (ESCOs);

- and application of the clean development mechanism (CDM).

These two mechanisms are sufficiently important and complex that they are addressed separately in Sections 8.7 and 8.8.

8.7 Energy performance contracts and ESCOs

If the project is to be financed externally, one of the attractive options for many organisations is the use of energy performance contracts delivered by energy service companies, or ESCOs.

ESCOs are usually companies that provide a complete energy project service, from assessment to design to construction or installation, along with engineering and project management services, and financing. In one way or another, the contract involves the capitalization of all of the services and goods purchased, and repayment out of the energy savings that result from the project.

In some contracts, the ESCO provides a guarantee for the savings that will be realized, and absorbs the cost if real savings fall short of this level. Typically, there will be a risk management cost involved in the contract in these situations. Insurance is sometimes attached, at a cost, to protect the ESCO in the event of a savings shortfall.

In other contracts, the ESCO may also undertake the provision of operating services such as plant maintenance, control of HVAC and lighting systems, or even complete physical plant operation. This is more common in commercial buildings than in industrial facilities.

8.7.1 The History of ESCOs

Performance contracting, while still relatively new to the industrial sector, has been a common feature in the commercial and institutional markets for several decades. It started in those sectors in part because the risks involved in guaranteeing energy savings and operating performance were lower.

ESCOs first appeared in Europe, where energy costs historically have been higher than in North America. ESCOs first appeared in the United States in the early 1960s. Many of the companies were subsidiaries of U.S. energy utilities.

Only recently have larger manufacturers begun to use performance contracting. However, even at this early stage of development performance contracting has attracted the involvement of major corporate giants like Ford, Nissan and Proctor & Gamble.

8.7.2 What is Performance Contracting?

The core of performance contracting is an agreement involving a comprehensive package of services provided by an ESCO, including:

- An energy efficiency opportunity analysis.
- Project development.
- Engineering.

- Financing.
- Construction/implementation.
- Training.
- Monitoring and verification.

The last component, monitoring and verification, is key to the successful involvement of an ESCO in performance contracting where energy cost savings are being guaranteed.

ESCOs are not "bankers" in the narrow sense. Their strength is in putting together a package of services that can provide guaranteed and measurable energy savings that serve as the basis for guaranteed cost savings. But, the energy savings must be measurable.

8.7.3 Benefits of Third-Party Financing

In a capital-tight operating environment, third party, off balance sheet financing can be an attractive alternative to corporate self financing against internal thresholds and competing internal priorities.

Performance contracting can provide the following benefits, in addition to energy efficiency improvements:

- Reduced or eliminated need for corporate capital - helping capital short companies implement energy efficiency initiatives that they could not otherwise finance directly.
- Helping capital available companies accelerate existing energy efficiency programs to enhance their cash flow, for use on other investments.
- Helping manage debt through off balance sheet financing
- Decreased operating costs.
- Turnkey installation.
- Participation of local energy utilities.
- Enhanced staff training.
- Savings fund repayments, based on performance against quantifiable results.
- Accelerated equipment upgrading, retrofits, and/or modernization -
- Transferred risk to a third party (ESCO).

8.7.4 Typical Questions From An ESCO

An ESCO experienced in the industrial sector can be expected to ask a variety of questions in the search for ways to improve energy efficiency. For example:

- Can production equipment be modernized or replaced cost effectively?
- Is the plant automated? Can more be done?
- Is water consumption high?
- Are sewer or water treatment costs high?
- Does heat recovery offer potential savings?

Positive answers to questions such as these provide evidence that potential exists for energy efficiency improvements.

8.7.5 Energy Efficiency Contracting Options

- **First Out** - ESCO retains savings until an agreed-upon financial goal is achieved; client company then receives future savings.

- **Shared Savings** - ESCO and client company share savings as they are achieved.

- **Guaranteed Savings** - ESCO guarantees project costs (exclusive of client add-ons); debt service is covered by the income stream.

- **Discounted Energy Savings (Chauffage)** - Client company pays ESCO a fee equal to the base year energy bill minus an agreed upon discount; ESCO pays actual energy bill.

Each of the above options have their own distinctive financial and tax implications.

For example, the Discounted Energy Savings approach can possibly be treated by the client company as 100% deductible as a service or operating cost. In this case the client company foregoes any depreciation on equipment.

In the First Out or Shared Savings options costs can be structured either as an ESCO service contract or a capital cost to the client company.

Sources of financing can include third party financing arranged by the ESCO as well as more traditional bank loans, asset financing companies (both direct or through the ESCO), the ESCO's own shareholders, or the equipment's manufacturer.

Here are several rules of thumb for performance contracting based on North American experience:

- ESCOs will take on energy efficiency investment projects in the $500,000 to $15,000,000 range. Some ESCOs will consider projects as small as $200,000, involving small to medium-sized companies.

- Banks, directly or through ESCOs, typically invest in 1 to 5-year opportunities; asset financing companies will undertake sales financing programs for equipment manufacturers in the 5 to 10 plus year, $10 million plus range (but will not themselves provide performance contracts or guarantees).

8.7.6 Managing the Risks

As with any contractual agreement, performance contracting brings with it its own risks.

Perhaps the most frequent cause of misunderstandings relates to the establishment of the Base Year and provisions for adjustments. The Base Year is the base line benchmark from which all energy savings are measured for the term of a performance contract.

Among the things that can affect the Base Year and related measurements of energy efficiency improvements are:

- Changed operating hours.
- Changed equipment.
- Rescheduled equipment operation.
- Unplanned changes in building use.
- Additional "plus-in" technology.

8.8 Clean Development Mechanism

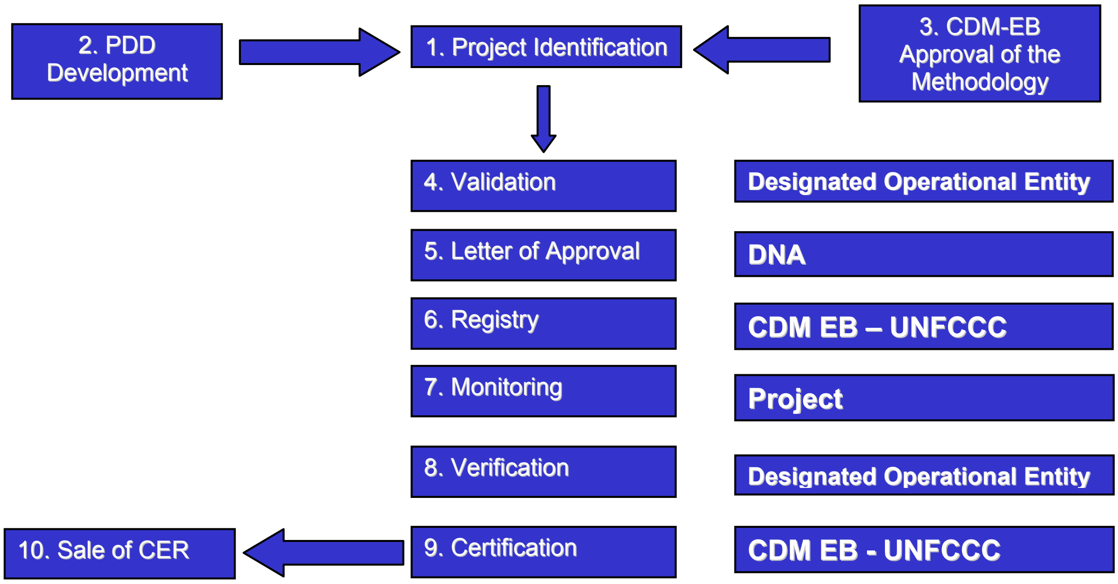
(Source: Marbek Resource Consultants Ltd., GERBI Project, Management Workshop, 2004)

As noted earlier, the Clean Development Mechanism may be a means of enhancing the financial merits of energy management projects, by taking advantage of the monetization of GHG emission reductions.

8.8.1 Steps to develop a CDM project

The flow diagram below represents the main steps to develop a CDM project:

Figure 8.2: CDM Project Development Process



1. **Project Identification:** Project must be identified according to the criteria presented in Sections 1.2.2.3 and 1.2.2.4.

2. **PDD Development**: A PDD (Project Design Document) must be elaborated, since it is the main document that will describe the CDM project as well as the emissions reduction the project will cause. The main items are:
   - **a.** The project description: a detailed description of the project, location, including the technology it will use, the main contribution to sustainable development, legal environmental aspects, “additionality” justification and baseline analysis (explaining why the project does not make part of the business-as-usual) and stakeholders’ comments.
   - **b.** Baseline Methodology: A methodology with a procedure for calculating the emissions and emissions reduction caused by the project must be developed, if no approved methodology in the UNFCCC’s website applies.
   - **c.** Monitoring Methodology: Similarly to the item b above, a new methodology must be developed to monitor, in a credible and accurate way, the emissions and emissions reduction of the project, if no other approved methodology apply.

3. **Methodology Approval:** Both new baseline and monitoring methodology designed to the proposed CDM project must be submitted to the Methodological Panel and approved by the CDM-EB (CDM Executive Board).

4. **Validation:** It is one of the most important phases of the project. It is when the project is validated (recognized) as a CDM project. A Designated Operational Entity (DOE), an UNFCCC's accredited company to perform the work of certifying that a project is indeed a CDM project. The DOE will thoroughly analyze the PDD and perform visit and interviews in the project site, ensuring that it is in compliance to the applicable laws and to what has been described in the PDD, as well as if the new (or the approved) methodologies are fully applicable to the project.

5. **Letter of Approval:** the host country DNA (Designated National Authority) must issue a Letter of Approval that will be submitted together with the PDD and a Validation Form (issued by the DOE in order to register the CDM project in the CDM-EB database.

6. **Registry:** if the project has fulfilled with items 2 through 5, the CDM Project can be registered in the CDM-EB. That means that a "CER account" will be created under the project participants name, so once a CER is issued to the project's account it can be transferred – under the same system – to any another account, for example the buyer's account.

7. **Monitoring:** It is the responsibility of the project (or the company proposing it) to monitor its emissions according to the approved monitoring methodology.

8. **Verification:** another DOE, or the same DOE in the case of a small scale project, shall perform the verification, periodically after the validation. It will assess whether the CDM project has monitored its emissions (and therefore, its emissions reduction) according to the approved methodology.

9. **Certification:** once verified the emissions reduction, the DOE will communicate it to the CDM-EB that will issue the CERs to the project participants' account.

10. **Sale of CER:** Having the CER in the account it can be transferred to the buyer. The transactions are usually set by a CERPA (Certified Emissions Reduction Purchase Agreement) in which all the terms, penalties and procedures are established. Liquidation is not yet in place within the UNFCCC system.

8.8.2 A brief note about the size of the project

Since the fixed transaction costs usually do not vary proportionally from project to project, there are some benefits for small scale projects to foster their inclusion in the mechanism. These small scale projects utilize simplified modalities procedures, such as lower rates to register the project in the CDM-EB database, already developed simplified methodologies (baseline and monitoring) available in the UNFCCC website and therefore lower rates for project design documenting, validation, registration and verification.

To be framed as a Small-Scale Project, the project must meet one the following requisites:

- Renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (or an appropriate equivalent).

- Energy efficiency improvement project activities which reduce energy consumption, on the supply and/or demand side, by up to the equivalent of 15 gigawatt hours per year.
- Other project activities that both reduce anthropogenic emissions by sources and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually.

Worksheet 8-1: Cash Flow Table

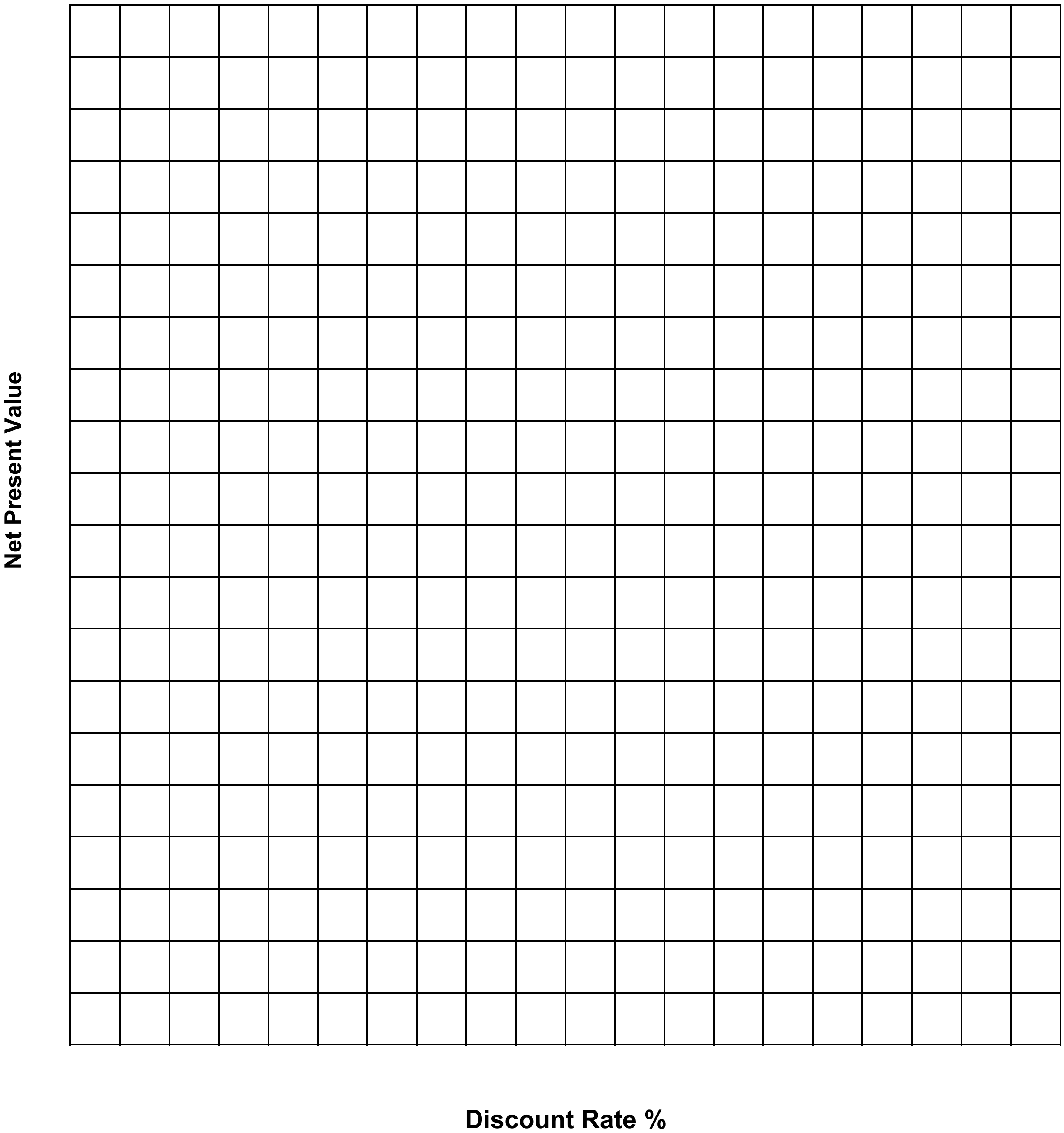
Measure:						
Capital Expenditure:						
Anticipated Savings:						
Year	**0**	**1**	**2**	**3**	**4**	**5**
Expected Costs						
Expected Savings						
Net Cash Flow						
Net Project Value						

Worksheet 8-2: Net Present Value Calculation

Table 5.2: 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

Year	**0**	**1**	**2**	**3**	**4**	**5**	**NPV**
Net Cash Flow							
Discounted Cash Flow							
10%							
20%							
30%							
40%							
50%							

Worksheet 8-3: Internal Rate of Return Calculation



Excel Spreadsheet Function:
Net Present Value (NPV)

Calculates the net present value of an investment by using a discount rate and a series of future payments (negative values) and income (positive values).

Syntax

NPV(rate,value1,value2, ...)

Rate   is the rate of discount over the length of one period.

Value1, value2, ...   are 1 to 29 arguments representing the payments and income.

- Value1, value2, ... must be equally spaced in time and occur at the end of each period.
- NPV uses the order of value1, value2, ... to interpret the order of cash flows. Be sure to enter your payment and income values in the correct sequence.
- Arguments that are numbers, empty cells, logical values, or text representations of numbers are counted; arguments that are error values or text that cannot be translated into numbers are ignored.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.

Remarks

- The NPV investment begins one period before the date of the value1 cash flow and ends with the last cash flow in the list. The NPV calculation is based on future cash flows. If your first cash flow occurs at the beginning of the first period, the first value must be added to the NPV result, not included in the values arguments. For more information, see the examples below.
- If n is the number of cash flows in the list of values, the formula for NPV is:
- NPV is similar to the PV function (present value). The primary difference between PV and NPV is that PV allows cash flows to begin either at the end or at the beginning of the period. Unlike the variable NPV cash flow values, PV cash flows must be constant throughout the investment. For information about annuities and financial functions, see PV.
- NPV is also related to the IRR function (internal rate of return). IRR is the rate for which NPV equals zero: NPV(IRR(...), ...) = 0.

Examples

Suppose you're considering an investment in which you pay $10,000 one year from today and receive an annual income of $3,000, $4,200, and $6,800 in the three years that follow. Assuming an annual discount rate of 10 percent, the net present value of this investment is:

NPV(10%, -10000, 3000, 4200, 6800) equals $1,188.44

In the preceding example, you include the initial $10,000 cost as one of the values, because the payment occurs at the end of the first period.

Consider an investment that starts at the beginning of the first period. Suppose you're interested in buying a shoe store. The cost of the business is $40,000, and you expect to receive the following income for the first five years of operation: $8,000, $9,200, $10,000, $12,000, and $14,500. The annual discount rate is 8 percent. This might represent the rate of inflation or the interest rate of a competing investment.

If the cost and income figures from the shoe store are entered in B1 through B6 respectively, then net present value of the shoe store investment is given by:

NPV(8%, B2:B6)+B1 equals $1,922.06

In the preceding example, you don't include the initial $40,000 cost as one of the values, because the payment occurs at the beginning of the first period.

Suppose your shoe store's roof collapses during the sixth year and you assume a loss of $9000 for that year. The net present value of the shoe store investment after six years is given by:

NPV(8%, B2:B6, -9000)+B1 equals -$3,749.47

Excel Spreadsheet Function: Internal Rate of Return (IRR)

Returns the internal rate of return for a series of cash flows represented by the numbers in values. These cash flows do not have to be even, as they would be for an annuity. However, the cash flows must occur at regular intervals, such as monthly or annually. The internal rate of return is the interest rate received for an investment consisting of payments (negative values) and income (positive values) that occur at regular periods.

Syntax

IRR(values,guess)

Values is an array or a reference to cells that contain numbers for which you want to calculate the internal rate of return.

- Values must contain at least one positive value and one negative value to calculate the internal rate of return.
- IRR uses the order of values to interpret the order of cash flows. Be sure to enter your payment and income values in the sequence you want.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored.

Guess is a number that you guess is close to the result of IRR.

- Microsoft Excel uses an iterative technique for calculating IRR. Starting with guess, IRR cycles through the calculation until the result is accurate within 0.00001 percent. If IRR can't find a result that works after 20 tries, the #NUM! error value is returned.
- In most cases you do not need to provide guess for the IRR calculation. If guess is omitted, it is assumed to be 0.1 (10 percent).
- If IRR gives the #NUM! error value, or if the result is not close to what you expected, try again with a different value for guess.

Remarks

IRR is closely related to NPV, the net present value function. The rate of return calculated by IRR is the interest rate corresponding to a 0 (zero) net present value. The following formula demonstrates how NPV and IRR are related:

NPV(IRR(B1:B6),B1:B6) equals 3.60E-08 [Within the accuracy of the IRR calculation, the value 3.60E-08 is effectively 0 (zero).]

Examples

Suppose you want to start a restaurant business. You estimate it will cost $70,000 to start the business and expect to net the following income in the first five years: $12,000, $15,000, $18,000, $21,000, and $26,000. B1:B6 contain the following values: $-70,000, $12,000, $15,000, $18,000, $21,000 and $26,000, respectively.

To calculate the investment's internal rate of return after four years:
IRR(B1:B5) equals -2.12 percent

To calculate the internal rate of return after five years:
IRR(B1:B6) equals 8.66 percent

To calculate the internal rate of return after two years, you need to include a guess:
IRR(B1:B3,-10%) equals -44.35 percent

Worksheet 8-4: An Energy Management Action Plan – Investment Practices

Item No.	Action	Measured Outcome	Accountability	Resource Needs	Start	End