

Chapter 27

Further Financial Topics

Abstract The aim of this chapter is to discuss a number of financial topics beyond the basic financial analysis methods that were introduced in Chap. 5. These topics are important in the management of assets. An understanding of these topics will be of value in contributing to asset management decisions. *Outcomes* You will learn about aspects of business financing, about comparing and selecting projects and issues involved in leasing. The chapter concludes with a consideration of the concepts of fixed and variable costs and break-even analysis.

27.1 Debt and Equity Financing

The capital used by a company generally has one of two types of source: debt capital or equity capital.

Debt capital is money borrowed from a bank or other source and the cost is the loan interest rate. The repayment schedule is a firm commitment and the business is insolvent if it cannot be met.

Equity capital is money provided by investors, either by the purchase of shares or as retained earnings. The cost reflects the expectations of shareholders, who benefit from dividends and also from any increase in the value of the company. Usually the expected return on equity is higher than on debt, but if business is bad, dividends can be reduced or omitted without the company becoming insolvent.

Gearing is the ratio of debt to debt plus equity. Since the interest on debt capital must be paid, a highly geared company is at relatively high risk.

Weighted Average Cost of Capital (WACC) is the cost of capital to the company, taking an average of the proportion of debt and the interest rate on debt with the proportion of equity and the expected return on equity.

27.2 Comparison and Selection of Projects

Asset investment criteria were introduced in Chap. 5, Sect. 5.4. Some additional considerations beyond the basic methods are outlined here.

27.2.1 Project Comparability

In making project comparisons it is important to ensure that the options are treated comparably in relation to:

- Starting conditions;
- Ending conditions;
- Project duration and duration of service;
- Performance and output planned and achievable.

The suggested basic method is to rank projects by their Profitability Index at the Minimum Acceptable Rate of Return. Where different production capacities are involved we need to consider cost per unit of production.

27.2.2 Planning Horizon

In analyzing an investment project we need to choose a planning horizon or planning cycle. Care must be exercised to ensure that the choice of horizon does not bias the result. Calculating an NPV for a finite horizon is the easiest method to comprehend. Be careful to set reasonable terminal values, such as written down values or resale values, depending on the age of items at the horizon. Discounting makes terminal values less critical in long projects. Annualized costs are useful as a basis for comparing costs incurred with differing life cycle durations.

27.2.3 With and Without Analysis

The financial measures described in Chap. 5 focused on specific discrete projects. In practice, projects may not be mutually exclusive, so that the choice of one project may mean that one of the others is not needed, or has to be modified. More generally, with many complex factors interacting, it may be advisable to consider the desirability of a project on a “with or without” basis. That is, we consider scenarios of what will happen if we *do* the project compared with what will happen if we *do not* do it. This approach can often clarify the situation and lead to a decision to proceed, not proceed, or to modify the project.

27.3 Inflation



Inflation means that identical goods cost more money now than they did a year ago. Equivalently, it means that prices were lower for the same items in the past. Deflation, on the other hand, corresponds to a decrease in the price of goods with time. The inflation rate is distinct from the interest rate. However, the two are not entirely unrelated, as the interest rate will normally exceed the inflation rate, otherwise there will be no attraction in saving or investing.

Historical average inflation rates are published by statistical authorities, for example, the Consumer Price Index (CPI). Where we wish to compare costs which are incurred a few years apart, we can bring them to a common reference date. This is usually the current year, and we then refer to the money unit as “*today’s dollars*.”

The expression “*real terms*” is used to indicate that a money quantity has been adjusted to allow for inflation. The unadjusted figures we refer to as “*nominal*” dollars. The inflation rate usually varies from year to year.

27.3.1 Adjusting Historical Costs

Consider a maintenance cost of \$6,500 incurred 2 years ago. We may wish to compare that in real terms with the cost of a similar task performed in the current year. If the inflation rate was 7 % last year and 9 % the year before, we must first inflate the cost by 9 % and then inflate the result by further 7 % to put the cost into today’s dollars. In this case the result would be:

$$\text{Cost in Today's Dollars} = 6,500 \times (1 + 0.09) \times (1 + 0.07) = 7,581 \quad (27.1)$$

Try this question.

\$20,000,000 was spent last year on maintaining a water supply system, \$20,500,000 is budgeted for this year. Inflation between the years was 4 %.

Which of the following is true?

- a. Expenditure has increased,
- b. Expenditure has declined in real terms.

(Answer: Both)

27.3.2 *Real Rate of Interest*

The “real” rate of interest is the annual increase in the value of invested money in terms of its purchasing power, allowing for inflation. In long-term financial analyses, such as life cycle costing, it is common to use the real rate of interest rather than the bank interest rate on loans.

The real rate of interest is approximately equal to the bank interest rate minus the inflation rate. Thus if the bank interest rate is 9 % and the inflation rate is 4 % then the real rate of interest is approximately 5 %. The precise relationship is given in Eq. 27.2.

r = bank interest rate as a decimal

f = inflation rate as a decimal

t = real interest rate as a decimal

$$t = (r - f) / (1 + f) \quad (27.2)$$

It is not unusual to use the approximation $t = r - f$, rather than the exact formula.

27.3.3 *Adjusting Future Costs*

Inflation and interest rates vary widely over time, and are hard to predict. In assessing real costs or values over long periods, great accuracy cannot be expected. Also, some items are not subject to inflation. For example, maintenance costs will inflate, but annual repayments and depreciation based on the original acquisition cost of an item will not inflate. As a guideline, in making financial planning calculations, adjust all inflatable amounts into today’s dollars and use the real rate of interest.

27.4 **Asset Valuation**

Asset valuation is subject to accounting rules and the relevant rules should be identified and applied. An asset manager should consult accounting professionals in regard to the preferred method for the circumstances.

The traditional financial value of an asset is the acquisition cost minus the accumulated depreciation. This is the conventional book value. This value is objective; that is, anyone applying the same rule will get the same result.

Another concept is “fair value” which involves estimating the Depreciated Current Replacement Cost.¹

27.4.1 Current Replacement Cost

The asset manager is generally concerned with maintaining an ongoing provision of assets. This involves making financial provision for the declining value of assets over their lifetime, but also involves considering changes in service requirements, in technology, and in the condition of particular assets. Relevant concepts are:

- Current Replacement Cost (CRC) is the cost which would be incurred if the item had to be replaced with the modern equivalent. This will take account of price changes, technical and regulatory developments, and changes to service expectations which have occurred since the original item was acquired.
- Expected Useful Life (EUL) is an estimate of the life of an asset, taking account of environmental or operational factors which may give a life which is different from the effective life set by accounting rules. The default value, however, is the effective life.
- Asset condition. See also Sect. 9.8 of this book. Normal depreciation reflects some loss of condition in a general sense. If the condition of an asset is significantly different from the norm for its age, then we need to take account of this.
- Expected Remaining Life (ERL). For an asset in average condition the Expected Remaining Life is the Expected Useful Life minus the Age. If the condition is significantly different from the norm for its age, then an ERL specific to the particular asset may be assigned.

27.4.1.1 Depreciated Current Replacement Cost

To obtain an asset valuation based on current costs we assess the current replacement cost of the item and then depreciate that to allow for the age of the current item in relation to its expected useful life. We refer to the result as the Depreciated Current Replacement Cost (DRC). The formula for the DRC of an item in average condition is:

$$\text{DRC} = \text{CRC} * (\text{EUL} - \text{Age}) / \text{EUL}. \quad (27.3)$$

¹ Fair value is defined in AASB116. Fair value measurement is considered in AASB13.

For an item whose condition is such that its Expected Remaining Life (ERL) differs from the average, the formula is:

$$\text{DRC} = (\text{CRC} * \text{ERL}) / \text{EUL}. \quad (27.4)$$

For example, consider an item with an effective useful life of 40 years and which is currently 20 years old and is in average condition. Its current replacement cost is assessed at \$50,000. Assuming straight line depreciation the assessed DRC by this method is $\$50,000 \times 20/40 = \$25,000$.

If the item is in poorer condition than average, we might assess its remaining life at 10 years, even though it is only 20 years old. In this case the DRC is $\$50,000 \times 10/40 = \$12,500$.

27.4.2 Deprival Value

This is the cost that would be incurred if the organization no longer had the item. The idea is that a like-with-like replacement would not necessarily occur due to wider changes in the business environment. On the one hand, an organization might be happy not to possess some of the assets which appear in its books, in which case the deprival value can be zero. At the other end of the scale, the deprival value takes account of how much worse off the owner would be if they did not have the asset, but wanted to continue on with business, taking all current and future considerations into account. For example, a person owns an old car with zero book value and zero resale value. However, the car serves the purposes of the owner, who would be faced with buying another if they were deprived of the old one. The deprival value can be highly volatile as circumstances change. This concept appears in some regulatory schemes.

27.4.3 Asset Value Index

An asset value index is a number which gives an indication of the value of the assets relative to the value of similar new assets. If we are using Depreciated Current Replacement Cost as the valuation method, we define an asset value index as the ratio of the Depreciated Current Replacement Cost (DRC) to the Current Replacement Cost:

$$\text{Asset Value Index} = \text{DRC} / \text{CRC} \quad (27.5)$$

Consider an asset with an effective life of 10 years, with straight line depreciation; when it is 5 years old its Asset Value Index, in percentage terms, will be 50 %.

The index can be applied to a group of assets by dividing the total Depreciated Current Replacement Cost of the group by the total Current Replacement Cost of the group. For the group, the Asset Value Index is given by:

$$\text{Asset Value Index} = \frac{\text{Group Total Depreciated Current Replacement Cost}}{\text{Group Total Current Replacement Cost}}$$

The index can be applied to the whole asset portfolio of an organization, so that a plant with all new assets would have an Asset Value Index of 100 %, while a plant with all very old assets which had been fully depreciated would have an Asset Value Index of 0 %. Taking it across the range of a company's assets, it indicates how the assets stack up in terms of their age relative to their effective lives. If the index is well below 50 %, then major capital expenditure is likely to be needed in the near future.

The Asset Value Index also serves as a pointer to the actions of management in relation to fixed assets. If the index is falling, we should expect evidence that the management is initiating plans for renewal at the appropriate times, and for the financing of the new items through a sinking fund or retained profits, for example. The Asset Value Index should be reported in the annual accounts, giving a direct insight into the asset health of the company. A low value does not indicate a bad situation provided that financial provision has been made for the replacements which will soon be needed.

27.5 Sinking Fund

A sinking fund is money that we accumulate so that we have it available when replacements or refurbishments of assets are needed. For example, the owners of an apartment block which has a swimming pool will want to refurbish the pool to current standards from time to time. To cover the cost of replacement or refurbishment we need to build up the sinking fund over the period leading to the time when the expenditure is needed. The guideline for how much should be in the sinking fund at any time is:

$$\begin{aligned} \text{Sinking Fund Amount} &= \text{Current Replacement Cost} \\ &\quad - \text{Depreciated Replacement Cost} \end{aligned}$$

If the sinking fund is held in an interest bearing account, we can take advantage of the interest generated. The discounted cash flow analysis of this situation is documented in finance textbooks.

27.6 Leasing

Leasing is hiring equipment rather than purchasing it. The lessee has the use of the equipment, but ownership remains with the lessor.

Features of leasing are:

- a. Often the cheapest way to meet a short-term requirement;
- b. Avoids a capital requirement.
- c. Avoids long-term commitment to specific assets, providing flexibility
- d. Reduces fixed costs. The fixed costs associated with the equipment become the responsibility of the lessor;
- e. Will generally be more expensive in meeting a long-term commitment, as the lessor will need to make a profit;
- f. The whole cost is tax deductible in current year.
- g. Risk in equipment reliability and performance is transferred to lessor.

In making a financial comparison, compare the lease cost rate with the EAC of ownership, or compare the total leasing cost with the NPV of ownership over the corresponding period.

27.7 Loan Repayment

Because interest payments are tax deductible, in some applications we may wish to calculate separately the amount of interest paid and the amount of capital repaid year by year on a loan. Suppose that we borrow an amount, known as the Principal, at a given interest rate, repayable by equal annual installments over a number of years. The Excel functions PPMT and IPMT give the capital and interest repayments year by year.

Figure 27.1 shows an example of the use of the Excel functions PPMT and IPMT to calculate loan repayment principal and interest. The loan amount is

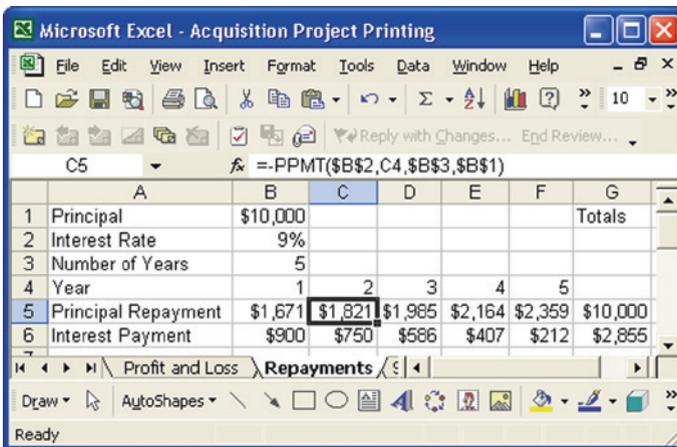


Fig. 27.1 Loan repayment calculations

\$10,000 shown in cell B1. The interest rate is 9 % shown in cell B2. The repayment period is 5 years shown in cell B3. The repayments of principal are shown in row 5 and of interest in row 6. As an example, the PPMT function for cell C5 appears in the function field. PPMT and IPMT reverse the sign from that of the Principal, so a minus sign has been used in the function field to give positive answers.

27.8 Fixed Costs, Variable Costs, and Break-Even Analysis

Fixed costs are costs which do not vary with the volume of business. Variable costs do vary with the volume of business. Examples of fixed costs are:

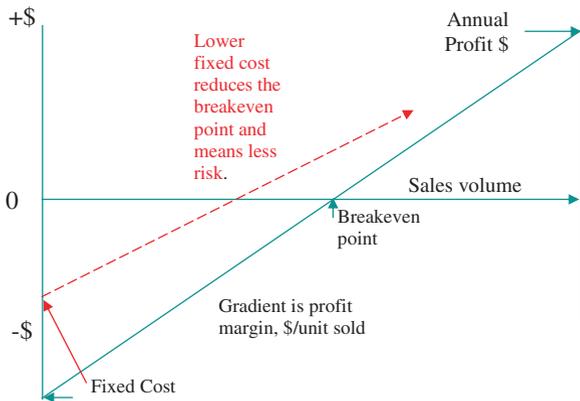
- The interest on loans for the purchase of plant or buildings;
- The cost of inspection of a boiler which is required to be carried out annually, regardless of the extent of utilization of the boiler.

Examples of variable costs are:

- Costs of materials used in manufacturing;
- Fuel costs which depend on volume of production or vehicle utilization.

The profit made by a company in a given year is based on the sales revenue minus the sum of variable and fixed costs. Products have an *operating profit margin*, given by their selling price minus the variable cost of production. As a year proceeds and sales are made, the cumulative operating profit increases, initially to cover the fixed costs and then to yield an overall profit. At a given operating margin, a business is more assured of avoiding a loss making situation if its fixed costs are low. This also applies even if the reduction in fixed costs causes a moderate loss in operating margin. Figure 27.2 illustrates the situation.

Fig. 27.2 Fixed and variable costs



For this reason, there is always a desire to reduce fixed costs. This can lead to pressure to reduce maintenance costs, which often include a large element of fixed costs. But there is then the danger that if the maintenance budget is too low, greater losses will occur, due to lack of machine availability, and that catastrophic failures may occur. Awareness of the fixed cost issue helps managers to assess the role of fixed and variable costs in a budget setting.

Leasing, renting, and outsourcing are activities that convert fixed costs to variable costs. They give a business greater flexibility in the event of a downturn in sales. However, if business is good, they tend to reduce profits by being more expensive than direct ownership.

27.9 Regulation

Regulation by government authorities is introduced to avoid excess profits in monopolies. Typically, this occurs when utilities are privatized in the electricity, water, gas, road, and rail industries. It is important to ensure that the regulatory regime does not discourage continuing investment.

27.9.1 Methods

The aim of the regulator is to limit the profit of the company to an acceptable level. This can be done by limiting the prices which to company can charge, or by limiting the revenue that they can generate. The following methods may be used:

- Pricing is restricted to cost plus
- Price cap. Prices are capped by the regulator
- Self-regulation—Set own rules but need to justify to regulator
- Revenue cap—based on asset replacement value or on depreciated asset replacement value

In an example of the revenue cap case the Maximum Allowable Revenue in year (MAR) is calculated as:

$$\text{MAR} = \text{Return on capital} + \text{Return of capital} + \text{opex}$$

$$\text{MAR} = (\text{WACC} * \text{WDV}) + \text{D} + \text{opex}$$

where

WACC Weighted Average Cost of Capital
 WDV Written Down Value of the assets
 D Depreciation in a year
 opex Operating expense

The regulator may specify that the operating expense should grow at less than the inflation rate, a rule known as CPI-X. There may be bonuses or deductions related to performance parameters such as on-time running of railways, power outages, water pressure loss.

A theoretical model used in regulation is the *Capital Asset Pricing Model*. A concept to come out of this is the risk parameter referred to as “beta”. A beta value of 1 represents the risk level of an average stock market investment. A beta value of less than one represents a safer investment, traditionally such as a utility. A beta value greater than one represents an investment which is considered riskier than the market average.

27.9.2 Need for Adequate Returns

If regulation provides too little return to a utility, investment in plant may decline, resulting in power shortages. Short-term investments (e.g., gas turbine power plants) may be made instead of long term. An example is a gas pipeline built on a government commitment to a gas retail price of \$1 per unit, but this was later reduced to 81 cents by the regulator, sending the pipeline owners into liquidation.

If regulated returns are based on book asset values, thus penalizing older assets, there will be a switch from a maintenance and refurbishment focus to the early acquisition of new plant.

27.9.3 Stranded Assets

A stranded asset is an asset which has lost value due to a change in circumstances. Example: Bell Bay power station in Tasmania runs on natural gas and produces power at a cost of about \$50 per Megawatt-hour. A cable, known as Basslink, was built later which supplies electricity to Tasmania from coal fired power stations in Victoria, where costs are about \$14 per Megawatt-hour. Bell Bay became a stranded asset (based on a Tasmanian newspaper report dated 1 June 2005).

27.10 Concluding Discussion

The primary role of the asset manager in regard to asset-based financial decisions is to ensure that decisions are in accord with the physical realities of the asset situation. This involves providing accurate data and sound technical assumptions which underpin the management decisions. An important part of the process is good communication between the asset management and finance groups. To achieve this communication, it is important that asset managers understand the

terminology and concepts employed by finance. The precise details of financial analysis will remain the responsibility of the finance department.

The examples in this chapter are intended to provide an introduction to the financial process, but local terminology and procedures may differ in detail from those given here. You should identify the precise forms of financial statements used within your organization.

27.11 Exercises

27.11.1 *Self-Assessment Quiz*

Explain the following terms:

1. Debt capital
2. Equity capital
3. Gearing
4. Weighted Average Cost of Capital (WACC)
5. Real rate of interest

Questions:

6. What is the normal method for valuing an existing fixed asset?
7. What is meant by the Current Replacement Cost of an item?
8. What is a sinking fund?
9. Identify four or more features of leasing rather than purchasing equipment.
10. What is the difference between fixed and variable costs?

27.11.2 *An Asset Investment Case Study*

The following example illustrates the use of the Profit and Loss account and an analysis of cash flows to evaluate the financial merits of a proposed development.

27.11.2.1 **Data**

The Token Power Company has the opportunity to develop a gas fired power station to provide electrical power for an industrial site. The cost data are shown in Fig. 27.3. For purposes of this example, the life of the plant has been set at a nominal 7 years. The plant is to be depreciated by the straight line method over 7 years.

In Fig. 27.3 we see that the initial cost of the plant is \$50 million. This is to be covered by a \$30 million loan and \$20 million in equity. The loan is to be repaid over 7 years. The revenue from the sale of electrical power is estimated at \$135

Fig. 27.3 Power system data

	A	B
1	Initial Cost	50,000,000
2	Loan	30,000,000
3	Equity	20,000,000
4	Interest Rate on Loan	8%
5	Discount Rate for Planning	10%
6	MARR	15%
7	Company Tax Rate	30%
8	Project Life Years	7
9	Annual Revenue	135,000,000
10	Annual Costs	100,000,000

million per year and the cost of providing this power (mainly the purchase of gas) is \$100 million per year. Figure 27.3 also shows the interest rate on the loan at 8 %, the company tax rate at 30 % and two interest rates used in planning analyses, namely a Planning Rate of 10 % and the Minimum Acceptable Rate of Return (MARR) of 15 %.

Your aim is to determine whether this Power Plant will be a good investment. Will it make a profit? What will be the payback period? What will be the Net Present Value over the 7 year period? Should we go ahead with the building of the power plant on the basis of the given data?

27.12 Exercise Solutions

27.12.1 Self-Assessment Quiz Solution

1. *Debt capital*

Debt capital is money borrowed from a bank or other source and the cost is the loan interest rate. The repayment schedule is a firm commitment and the business is insolvent if it cannot be met.

2. *Equity capital*

Equity capital is money provided by investors, either by the purchase of shares or as retained earnings.

3. *Gearing*

Gearing is the ratio of debt to debt plus equity.

4. *Weighted Average Cost of Capital*

Weighted Average Cost of Capital (WACC) is the cost of capital to the company, taking an average of the proportion of debt and the interest rate on debt with the proportion of equity and the expected return on equity.

5. *Real rate of interest*

The real rate of interest is the annual increase in the value of invested money in terms of its purchasing power, allowing for inflation.

6. *What is the normal method for valuing an existing fixed asset?*

The normal method of valuation of an asset is the acquisition cost minus the accumulated depreciation.

7. *What is meant by the Current Replacement Cost of an item?*

Current Replacement Cost (CRC) is the cost which would be incurred if an existing item has to be replaced with the modern equivalent.

8. *What is a Sinking Fund?*

A sinking fund is money that we accumulate so that we have it available when replacements or refurbishments of assets are needed.

9. Identify four or more features of leasing rather than purchasing equipment.

Features of leasing are:

- a. Often the cheapest way to meet a short-term requirement;
- b. Avoids a capital requirement. This is an advantage if there is a restriction on available capital.
- c. Avoids long-term commitment to specific assets, providing flexibility
- d. Reduces fixed costs. The fixed costs associated with the equipment become the responsibility of the lessee;
- e. Will generally be more expensive in meeting a long-term commitment;
- f. The whole cost is tax deductible in the current year.
- g. Risk in equipment reliability and performance is transferred to lessor.

10. What is the difference between fixed and variable costs?

Fixed costs are costs which do not vary with the volume of business. Variable costs do vary with the volume of business.

27.12.2 Asset Investment Case Study Solution

27.12.2.1 Profit and Loss Accounts

In order to determine the profitability of the proposal we develop projected Profit and Loss accounts for the 7-year period. Figure 27.4 shows this.

Row 13 shows the projected revenue of \$135,000,000 per year.

Row 14 shows the operating costs incurred in generating the revenue.

Row 15 shows the operating profit.

The initial cost of the plant, \$50 million, is depreciated linearly over seven years as shown in row 16. The \$30 million loan is repaid over the 7 years. The Excel functions PMT, IPMT and PPMT are used in rows 17, 18, and 19 to calculate the annual repayments and the split of these between interest expense and capital repayments. The interest expense is tax deductible.

The taxable income is then calculated (row 21) and also the tax paid (or to be paid) at row 22. This gives the profit (after tax) shown at row 23. In round figures and without discounting, the profit is approximately \$25 million per year. We need to relate this to accepted criteria for return on investment.

	A	B	C	D	E	F	G	H	I
12 Year(EOY)		0	1	2	3	4	5	6	7
13 Revenue			135,000,000	135,000,000	135,000,000	135,000,000	135,000,000	135,000,000	135,000,000
14 Costs			100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000
15 Revenue-Cost			35,000,000	35,000,000	35,000,000	35,000,000	35,000,000	35,000,000	35,000,000
16 Depreciation			7,142,857	7,142,857	7,142,857	7,142,857	7,142,857	7,142,857	7,142,857
17 Repayments			5,762,172	5,762,172	5,762,172	5,762,172	5,762,172	5,762,172	5,762,172
18 Interest			2,400,000	2,131,026	1,840,535	1,526,804	1,187,974	822,038	426,828
19 Principal Paid			3,362,172	3,631,146	3,921,637	4,235,368	4,574,198	4,940,134	5,335,344
20 Loan Remaining			26,637,828	23,006,682	19,085,045	14,849,676	10,275,478	5,335,344	0
21 Taxable Income			25,457,143	25,726,117	26,016,608	26,330,339	26,669,169	27,035,105	27,430,315
22 Tax Paid			7,637,143	7,717,835	7,804,982	7,899,102	8,000,751	8,110,531	8,229,095
23 Profit (after tax)			24,962,857	25,151,139	25,354,483	25,574,095	25,811,275	26,067,430	26,344,078

Fig. 27.4 Profit and loss

27.12.2.2 Investment Analysis for the Power System Project

To evaluate the Power System project we apply the following methods:

- Payback Period
- Net Present Value
- Internal rate of Return

Payback Period

The calculation of the payback period is shown in Fig. 27.5 at rows 25–29. The amount invested in the project is \$50 million, but this reduces as the loan is repaid. The equity plus loan remaining in the project is shown at row 28. The cumulative present value of the profit is shown in row 27. The payback period is reached when the cumulative present value of the profit exceeds the equity plus loan remaining in the project. At that point our costs are recovered. This occurs by the end of year 2, so the payback period is 2 years. This is a positive indicator for this investment, as the short payback period indicates that there is relatively little risk of our forecasts going wrong before the investment is recovered.

	A	B	C	D	E	F	G	H	I
24									
25 Year		0	1	2	3	4	5	6	7
26 Payback Period Analysis at Planning Rate (10%)									
27 NPV of Cumulative Profit			22,693,506	43,479,572	62,528,770	79,996,221	96,022,992	110,737,377	124,256,054
28 Equity+Loan Remaining		50,000,000	46,637,828	43,006,682	39,085,045	34,849,676	30,275,478	25,335,344	20,000,000
29 The NPV of cumulative profit exceeds the Equity +Loan Remaining by end of year 2. Payback period is 2 years.									
30									
31 NPV of Project at Planning Rate (10%)									
32 Cash flow		-20,000,000	21,600,685	21,519,993	21,432,845	21,338,726	21,237,077	21,127,297	21,008,733
33 NPV of project at Plan Rate		\$83,992,720							
34									
35 Internal Rate of Return (IRR)		107%		This comfortably exceeds the MARR of 15%					

Fig. 27.5 Investment analysis

Net Present Value

Calculate the cash flow year by year for the project and use this to calculate the NPV of the project. Note that in the spreadsheet we have used “year zero” to hold the initial costs. In year zero the cash flow is $-\$20$ million, which is the equity invested, and in subsequent years the cash flow is given by:

$$\text{Cash Flow} = \text{Revenue} - \text{Cost} - \text{Repayments} - \text{Tax}$$

This is shown in row 32.

The NPV of the cash flow, including the initial equity input, is then calculated and shown at row 33.

The result is $\$83,992,720$. This is the value of the project. The calculations so far were carried out at the Planning Rate of 10 % interest. We see that the investment of $\$20$ million in equity produces a return of $\$83,992,720$ on this basis. This is clearly a good investment.

Internal Rate of Return

Our next step is to calculate the internal rate of return corresponding to the cash flows in row 32. We use the Excel IRR function and get the value of 107 %. This is shown at Cell B35. This confirms that this is an excellent investment and is well above the Minimum Acceptable Rate of Return (MARR) which was specified as 15 %.

Return on Investment

The value of the assets involved in the project vary over the period of the investment, starting at $\$50$ million and finishing at zero. Averaging these figures gives an average asset value of $\$25$ million. The annual profit is approximately $\$25$ million also, so the return on investment is about 100 % per annum. We have not formalized this in the spreadsheet as it is only a rough calculation.

Conclusion

The power station is a good investment. It has a short payback period, a substantial net present value in relation to the equity investment and an internal rate of return which is well above the hurdle rate. We should go ahead.