



# BUSINESS ANALYSIS

## Overview

Energy performance can increase the value of an organization by improving the bottom line. The bottom line in business is net income or earnings; reduced energy costs can be reflected in increased earnings and earnings per share. Every dollar of increased earnings can be valued at the prevailing market earnings multiple, or the Price Earnings Ratio. This approach to valuation is common practice among analysts, who routinely relate market prices for shares of stock to multiples of earnings. You can also use this approach to determine the value of energy performance for your business— that is, increased market capitalization. ENERGY STAR provides tools that quantify, justify and communicate the impact of energy performance to a company's worth.

The process to improved energy performance requires that the financial merits of opportunities be carefully evaluated. All organizations employ basic financial analysis tools to examine the value, risk, and liquidity impacts of investment opportunities competing for limited capital resources. To successfully compete against other business investments, energy performance should be evaluated on the same basis. Understanding basic financial concepts and using simple analysis tools can facilitate an informed decision.

This chapter explains the tools necessary to evaluate profitability, cash flow, and liquidity and presents a framework for using these tools to analyze building upgrade investments to improve energy performance.

## Capital Budgeting Basics

Both for-profit and not-for-profit organizations evaluate potential investments based on net income (bottom line). To evaluate net income, an organizations use financial analyses to identify whether an investment exceeds a predetermined hurdle rate while maintaining acceptable first cost and liquidity requirements. Profitability is measured by whether a project's internal rate of return passes the investment hurdle rate. Cash flow and liquidity are evaluated by first cost and payback.

- *First cost* is the up-front cost that is incurred before the investment generates any savings. Large first costs put stress on an organization's balance sheet and may cause an investment to be rejected, even if it is profitable in the long run.
- *Net present value (NPV)* is the total net cash flow that a project generates over its lifetime, including first costs, with discounting applied to cash flows that occur in the future. NPV indicates what a project's lifetime cash flow is worth today.
- *Simple payback* is the amount of time, in years, necessary for future cash flows to



return the original investment. Payback is an indicator of liquidity because it measures the speed with which an investment can be converted into cash. Payback is also used as an indicator of risk. As a general rule, short-term events can be predicted more precisely than events in the distant future. Therefore, assuming everything else is constant, projects with a shorter payback period are generally considered less risky.

- *Internal rate of return (IRR)* is the interest rate that equates the present value of expected future cash flows to the initial cost of the project. Expressed as a percentage, IRR can be easily compared with loan or hurdle rates to determine an investment's profitability.
- *Hurdle rate* is the accept/reject criterion for determining if an investment passes the profitability test. If the IRR is higher than the hurdle rate, the investment is profitable. Hurdle rates are the marginal cost of capital, adjusted for a project's risk. The higher the cost of capital and risk, the higher the required hurdle rate.

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#### Capital Budgeting Glossary

Cost of capital	The discount rate that is used in the capital budgeting process.
Discount rate	The interest rate used to discount future revenue streams.
Hurdle rate	The minimum acceptable internal rate of return for a project.
Internal rate of return	The interest rate that equates the present value of expected future cash flows to the initial cost of the project.
Net present value	The present value of the expected net cash flows of an investment, discounted at an appropriate percentage rate, minus the initial cost outlay of the project.
Simple payback	The number of years required to return the original investment from net cash flows.
Time value of money	Money received today is valued more highly than money received at a future date.

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### Net Income Analysis

Evaluating investment in long-term building projects requires tools that consider cash flow over the life of a project and account for the time value of money. Simple payback, although frequently used in the energy management industry, is not a good indicator of profitability because it does not consider returns beyond the payback period and ignores the time value of money. The most common tools to evaluate investments are IRR and NPV. IRR is used to compare a project's return against a hurdle rate to determine whether it meets financial criteria and worth pursuing. NPV is useful for comparing and prioritizing amongst competing projects. Together, they provide a comprehensive evaluation of a project's contribution to the bottom line.

In addition to evaluating investment returns, determining the financial value of energy performance investments and its effect on the bottom line is equally important. While NPV can be used to demonstrate today's value of an investment and future returns, understanding how energy performance can impact key financial and profitability metrics such as profit margin, earnings per share, net reserve, and



market capitalization should be considered in capital decision making. Valuing the incremental earnings that result from improved energy performance is a way to capture the true worth to an organization. ENERGY STAR has developed a financial value calculator (fvc) to analyze how energy performance projects can improve an organization's net income and corporate value. Visit ENERGY STAR Web site at [www.energystar.gov](http://www.energystar.gov).

## Financial Evaluation

ENERGY STAR encourages using energy performance measurement and/or equipment upgrades to maximize energy savings while improving building comfort and indoor air quality. The following framework provides a systematic approach to evaluating energy performance investments and can be applied to comprehensive building upgrades or new designs.

1. Prepare a cash flow analysis for each upgrade or design option.
2. Calculate IRR for each option. Determine each option's profitability against the hurdle rate.
3. Compare competing options and prioritize options within a package using NPV.
4. Maximize energy efficiency by packaging upgrade options or carefully integrating systems where appropriate.

## Business Analysis Process

### *Cash Flow Analysis*

Evaluating profitability with IRR and NPV requires the preparation of a cash flow analysis. A simple cash flow estimate (see Table 1) should be prepared for each potential energy-performance option suggested by an energy audit. Cash flow analysis can also be used to compare the theoretical performance of an efficient building design to that of a conventional design. This analysis lists the year-to-year costs and savings for all implementation, operation, maintenance, and disposal costs, and energy and demand savings, over the life of the equipment or building. For this demonstration the investment is evaluated over a period of 10 years. Each option generally has a first cost and a stream of cost savings. In our example, the first cost is the installation cost, which occurs in year zero. In the unusual case that the retrofit is planned over multiple years, provide an estimate of the cost for each year in which the work will be completed. Be sure to document the projected schedule in the list of key assumptions.

*Project energy cost savings.* Typically, an energy audit report converts your energy and demand savings into monetary savings based on your current energy rates and operating schedules. Similarly, computer energy simulation can estimate annual savings associated with an efficient design. If you anticipate energy price changes, you may want to adjust the amount of savings in future years. Also, for a multiyear



project, you will need to phase in the energy savings over the first few years as appropriate. Be sure to document the energy rates that are used for the calculation and the planned operating schedules in the list of key assumptions. In our example, the energy prices and operating schedules will remain constant over the 10-year life of the equipment.

Table 1: Cash Flow Analysis For LED Exit Signs

Year	Retrofit Cost	Energy & Demand Savings	Maintenance Savings	Omitted Savings	Risk Level
0	\$ 3,250	\$ 0	\$ 0	Neutral	Neutral
1	0	2,181	200		
2	0	2,181	200		
3	0	2,181	200		
4	0	2,181	200		
5	0	2,181	200		
6	0	2,181	200		
7	0	2,181	200		
8	0	2,181	200		
9	0	2,181	200		
10	0	2,181	200		

Key Assumptions:

1. Retrofit will be completed in 3 months.
2. LED exit signs have a 10-year life expectancy.
3. Energy savings are based on the current average energy rate of \$0.078/kWh.
4. No changes in energy rates will occur during the 10-year period.
5. Maintenance savings are realized because lamps are changed less frequently.

*Estimate the annual savings in maintenance costs.* In our example, we are replacing incandescent exit signs with LED signs, and can thus realize substantial savings in labor and materials over the life of the equipment. In some cases, an energy-efficient retrofit can require more maintenance than before, resulting in a negative maintenance savings entry. Document all key assumptions regarding maintenance savings.

*Provide qualitative guidance.* Additional savings or costs can be difficult to quantify. Potential savings that are hard to measure include worker productivity gains, increased sales attributable to the upgrade, and enhanced corporate image. Omitted savings/costs should simply be classified as having a negative, neutral, or positive influence on the net annual cash flow. For all six of the lighting options in the example, omitted costs/savings are neutral, even though evidence suggests that office lighting retrofits can increase worker productivity.

Classifying the risk level of the project can also be difficult. Because of uncertainty about future events (for example, future prices of electricity), anticipated cash flows may be difficult to estimate. However, compared with other investments that a





company may make, such as new product development, energy efficiency projects are still considered a low risk. If you do not know the risk levels of other investments your organization is considering, you may want to classify the risk of energy-efficient investments as neutral to be conservative.

Cash flow analyses for most options will follow this simple example, in which the initial cost occurs in year zero, savings estimates are constant over the life of the project, and risk and omitted cost/savings are neutral.

#### *Cash Flow Assumptions*

Estimating cash flow is the most difficult part of any financial analysis. While initial retrofitting or construction costs can be estimated based on experience, estimates of energy savings and operation and maintenance costs savings are based on more extensive assumptions that may be affected by numerous variables. Because future events may not occur as anticipated in your assumptions, the IRR realized for the project may vary considerably from your original estimate. Recognizing this uncertainty, you should explicitly list the assumptions underlying your cash flow estimates, and reach a consensus with other staff that these assumptions are reasonable. At a minimum, assumptions that should be documented are the future prices of energy and your basic operating conditions.

Taxes can also affect your cash flow estimates. Increasing depreciation, decreasing energy and maintenance expenses, and, if your project is debt financed, increasing the amount of your interest deduction can affect an organization's tax liability. If you are unfamiliar with these tax implications, simply omit them from your analysis and express your results in pre-tax terms.

#### *Profitability Test*

If all the options being considered have a single-payment first cost, cash flows that are uniform for the entire time horizon, and equal-length life spans, you can easily determine IRR using a calculator and Table 2. Using the table, a 20% IRR hurdle rate would result in a simple payback of 4.2 years, options with less than a 4.2-year simple payback would be considered profitable.

Calculate the IRR for each project, and simply compare it to your hurdle rate. If the option exceeds the established hurdle rate, that project would be considered profitable and should be pursued. IRR should be used to determine profitability for each project. It should not be used to compare or prioritize projects; this approach can minimize first cost rather than maximizing energy performance and long-term savings.



Table 2: Project IRR After Simple Payback

Payback (years)	Time Horizon (years)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.0	0.0%	61.8%	83.9%	92.8%	96.6%	98.4%	99.2%	99.6%	99.8%	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%
1.5		21.5%	44.6%	55.2%	60.4%	63.1%	64.6%	65.5%	66.0%	66.3%	66.4%	66.5%	66.6%	66.6%	66.6%
2.0		0.0%	23.4%	34.9%	41.0%	44.5%	46.6%	47.8%	48.6%	49.1%	49.4%	49.6%	49.7%	49.8%	49.9%
2.5			9.7%	21.9%	28.6%	32.7%	35.1%	36.7%	37.8%	38.5%	38.9%	39.2%	39.5%	39.6%	39.7%
3.0			0.0%	12.6%	19.9%	24.3%	27.1%	29.0%	30.2%	31.1%	31.7%	32.2%	32.5%	32.7%	32.9%
3.5				5.6%	13.2%	18.0%	21.1%	23.2%	24.6%	25.7%	26.4%	26.9%	27.3%	27.6%	27.9%
4.0				0.0%	7.9%	13.0%	16.3%	18.6%	20.2%	21.4%	22.3%	22.9%	23.4%	23.7%	24.0%
4.5					3.6%	8.9%	12.4%	14.9%	16.7%	18.0%	18.9%	19.6%	20.2%	20.6%	20.9%
5.0					0.0%	5.5%	9.2%	11.8%	13.7%	15.1%	16.1%	16.9%	17.6%	18.0%	18.4%
5.5						2.5%	6.4%	9.2%	11.2%	12.7%	13.8%	14.7%	15.3%	15.9%	16.3%
6.0						0.0%	4.0%	6.9%	9.0%	10.6%	11.8%	12.7%	13.4%	14.0%	14.5%
6.5							1.9%	4.9%	7.1%	8.7%	10.0%	11.0%	11.8%	12.4%	12.9%
7.0							0.0%	3.1%	5.3%	7.1%	8.4%	9.5%	10.3%	11.0%	11.5%
7.5								1.5%	3.8%	5.6%	7.0%	8.1%	9.0%	9.7%	10.2%
8.0								0.0%	2.4%	4.3%	5.7%	6.9%	7.8%	8.5%	9.1%
8.5									1.2%	3.1%	4.6%	5.7%	6.7%	7.5%	8.1%
9.0									0.0%	2.0%	3.5%	4.7%	5.7%	6.5%	7.2%
9.5										0.9%	2.5%	3.8%	4.8%	5.6%	6.3%
10.0										0.0%	1.6%	2.9%	4.0%	4.8%	5.6%

### Prioritize Options

To compare two competing options or to prioritize options, a net present value (NPV) analysis should be used. NPV discounts the future total net cash flow over a project's life, and tells you what a project's future cash flow is worth in today's dollars. As with IRR, NPV is calculated by using a financial calculator or spreadsheet. Note that IRR and NPV are related, a negative NPV indicates that the option generates less than the established rate of return.

For example, you have the option of controlling lighting with a Central Time clock or individual occupancy sensors. Table 3, illustrates that the time clock has a higher IRR and quicker payback, but NPV analysis suggest that occupancy sensors would increase energy savings and net worth of your organization. Similarly, NPV can be used to prioritize and rank the value of options within a package of upgrades (see Table 4).

### Bundle Upgrades

What about options that are considered marginally profitable, but can still contribute to maximizing the energy efficiency of a project? In our example, improving office task lighting, when evaluated individually, does not meet our required hurdle rate. However, when task lighting is packaged with the other more profitable aspects of lighting upgrades, the combined project IRR still exceeds the hurdle



rate. By using an integrated approach, the task lighting can be included in the upgrade package and still meet investment criteria.

Table 3: Comparing The Profitability Of Upgrade Options

Year	Upgrade Option 1A Occupancy Sensors		Upgrade Option 1B Central Timeclock	
	Initial Cost	Savings Generated	Initial Cost	Savings Generated
0	\$ 42,000	\$ 0	\$ 9,000	\$ 0
1	0	12,200	0	3,550
2	0	12,200	0	3,550
3	0	12,200	0	3,550
4	0	12,200	0	3,550
5	0	12,200	0	3,550
6	0	12,200	0	3,550
7	0	12,200	0	3,550
8	0	12,200	0	3,550
9	0	12,200	0	3,550
10	0	12,200	0	3,550
<i>Cumulative Savings</i>				
Over Ten Years		\$ 122,000		\$ 35,500
Simple Payback		3.4 years		2.5 years
IRR		26%		38%
NPV		\$ 7,623		\$ 4,903

In another example, including a daylight dimming option would not be pursued, because it is not profitable both when evaluated on its own and as part of the overall upgrade package. Incremental costs alone should not dissuade the specifier from including an option that is marginally profitable. Options can be quantified in terms other than cost, particularly if the option can significantly improve aesthetics or lighting quality, or provide other non-tangible benefits.

### Other Considerations

Remember that these financial calculations are based on key assumptions. If any of your assumptions change, analyze all of the options again before going forward with a proposed package of options. Another important factor that may affect the decision to pursue an energy-performance investment is the manner in which the project is financed. Financing options affect the balance sheet in different ways and can be a determining factor on whether to accept an investment proposal. See the Financing chapter in this manual for more information on loans, leasing, performance contracting, and other financing alternatives.



Table 4: Assemble A Profitable Package

<i>Stage Two Lighting Options</i>	<i>NPV</i>	<i>First IRR</i>	<i>Annual Net Cost</i>	<i>Cash Flow</i>	<i>Omitted Savings</i>	<i>Risk</i>
1a Install Occupancy Sensors	\$7,623	26%	\$42,000	\$12,200	Neutral	Neutral
1b Install Central Timeclock	4,902	38%	9,000	3,550	Neutral	Neutral
2 Install LED Exit Signs	5,606	73%	3,250	2,380	Neutral	Neutral
3 Improve Corridor Lighting	5,106	38%	9,490	3,725	Neutral	Neutral
4 Improve Office Lighting	4,751	23%	57,605	15,100	Neutral	Neutral
5 Upgrade Task Lighting	(929)	16%	9,500	2,000	Neutral	Neutral
6 Install Daylighting Controls	(26,524)	2%	59,080	6,500	Neutral	Neutral
<i>Package Results</i>						
Options 1a-4	\$23,091	27%	\$112,345	\$33,405		
Options 1a-5	\$22,161	26%	\$121,845	\$35,405		
Options 1a-6	\$(4,363)	19%	\$180,925	\$39,905		