This section covers three simplified methods – simple payback, net present value and constant dollar value – to gain a quick feel for the value of your planned energy efficiency and building projects. If you are interested in an in-depth analysis, financial consultants will assist you in determining whether the dollars you spend are put to their best use and work as hard for you as your community has worked for them.

Each facility takes a different approach to finances, depending upon where you get your funds, how you spend them, the people involved, and the traditions established in your community. Financial priorities will influence when and what you spend your money on, as well as the types of projects you undertake, from repair to replacement. Some communities take out loans; others insist that all money is in the bank first.

Considering your options

When considering project options, look at your current facilities and plan for the future. Remember that all buildings and facilities require regular maintenance and up-keep to ensure a long life, but eventually everything wears out and needs to be replaced. (See Section 10 for detailed project and facility planning options and analysis.) Energy efficiency projects are a realistic way to save dollars and reduce expenses. Analyze your options to determine their impact on facility operation and cost.

Simple operating adjustments can yield savings without cash outlay. It costs money up front to modify, replace, or add equipment, but doing so saves dollars in the long run. Before acting on opportunities to implement measures to reduce operating costs significantly, consider them carefully to avoid costly mistakes.

If your facility relies on fund-raising or government grants for money, you will appreciate that it is far easier to raise money to cover new projects than it is to cover operating and maintenance costs.

Cost/benefit analysis

A cost/benefit analysis is simply a way of looking at an investment to determine if the benefit justifies the cost. The value of the benefit is often difficult to establish, especially in public facilities. For example, a remodeled entry-way will not generate revenue by itself, but, if the improvement makes the facility more accessible and attractive to the public and can lead to increased attendance, the benefit becomes real.

Energy efficiency projects generally show a direct benefit in reduced operating costs. The cost of the project can be directly compared to the savings in utility costs. Lowering facility maintenance costs is another type of benefit; 50 to 60 per cent of a rink's annual expenditures typically go toward wages and maintenance. Projects that reduce the need for maintenance or extra staff will have a significant effect on the bottom line.

For example, installing plastic coverings over pipes and tanks that are customarily painted every year will eliminate annual painting and reduce maintenance requirements. Similarly, installing a low emissivity ceiling may eliminate the need to paint the ceiling every 10 years.

Simple payback

Simple payback is a quick analysis that looks only at paying back the capital cost. Although simple payback is commonly used to evaluate energy efficiency projects, it must be used with caution because it over-simplifies often complex financial and economic situations.

Example 3.1 - Simple payback of a project

If a new heating system cost of $28,000 could save $5,600 a year in energy costs, the simple payback is:

28,000/5,600 = 5.0 years

In roughly five years you will have saved enough money through reduced energy costs to pay back the capital cost of the installation. Note that this approach excludes financing costs and energy inflation costs.

Net present value (NPV)

Net present value (NPV) measures the excess or shortfall of cash flows, taking the time value of money into account. The time value of money is the cost of capital, or financing costs, if the project is financed.

NPV is the sum of all cash flows associated with an investment, with each cash flow discounted back to a base year (usually the current year). The discount rate used is the cost of capital.

Any money manager expects a specific minimum return on an investment. (A return of 12 per cent is used throughout these guidelines.)

NPV indicates how much better or worse than the specified return (12 per cent) your proposed investment will be. A positive calculation indicates better than a 12 per cent return on investment. A negative value indicates worse than a 12 per cent return on investment. The larger the value is positive, the greater the financial benefit the project will provide.

Example 3.2 - NPV calculation

Referencing Example 3.1, if an owner invests the required $28,000 using a 12 per cent annual rate over the 10-year useful life of the project, then an NPV can be calculated using the annual savings of $5,600:

$$NPV = (-28{,}000) + 5{,}600/(1.12) + 5{,}600/(1.12)^2 + \ldots + 5{,}600/(1.12)^{10}$$

NPV = + 3,641

After accounting for the 12 per cent financing costs, the project will generate a gain of $3,641.

Note that the analysis has not escalated annual savings, however as utility rates go up, so should savings. If the rates were to go up 5 per cent per year, the NPV would become:

$$NPV = (-28{,}000) + 5{,}600 \times (1.05/1.12) + 5{,}600 \times (1.05/1.12)^2 + \ldots + 5{,}600 \times (1.05/1.12)^{10}$$

NPV = + 11,945

If utility rates increase at 5 per cent, the project will generate a gain of $11,945, accounting for the 12 per cent cost of capital.

This analysis ignores a number of key factors:

- How does the new equipment interact with existing equipment? Will existing equipment operate less and therefore last longer?
- Delaying replacement of expensive equipment should be of some value, shouldn't it? How about maintenance costs; are these affected as well?
- A proper financial analysis considers all related costs and benefits, direct and indirect, over the project life.

Table 3.1 - Net present value: capital reserves

Year	Future energy savings ($)	Present net annual cash flow ($)	Present cumulative cash flow ($)
0	0.00	-28,000.00	-28,000.00
1	5,880.00	5,250.00	-22,750.00
2	6,174.00	4,921.88	-17,828.13
3	6,482.70	4,614.26	-13,213.87
4	6,806.84	4,325.87	-8,888.00
5	7,147.18	4,055.50	-4,832.50
6	7,504.54	3,802.03	-1,030.47
7	7,879.76	3,564.40	2,533.94
8	8,273.75	3,341.63	5,875.56
9	8,687.44	3,132.78	9,008.34
10	9,121.81	2,936.98	11,945.32

Future energy savings values are based on the formula $5{,}600 \times (1 + 0.05)^n$ where n = year number and utility rates increasing at 5 per cent.

For example, in year 5, the future energy savings will be:

$$5{,}600 \times (1 + 0.05)^5 = 7{,}147.18$$

Present dollar net annual cash flow values for this example in year 5, using the 12 per cent financing costs, will be:

$$7{,}147.18 / (1 + 0.12)^5 = 4{,}055.50$$

Payments in year zero represent the purchase price.

Constant Dollar Value

The Constant Dollar Value method takes inflation into account. All costs and prices are discounted by the assumed rate of inflation to express the dollar values in terms of the starting year's dollar. The cost of money is not considered in this analysis.

Example 3.3 - Constant Dollar Value

An item worth $1,000 today will cost $1,040 a year from now, if inflation is 4 per cent per year. Conversely a payment of $1,000 due a year from now is worth $961.54 in today's dollars. You can calculate this with the following formula:

$$\mathbf{CDV} = \frac{\mathbf{FDV}}{\mathbf{(1 + i) \times n}}$$

Where:

CDV = Constant Dollar Value
FDV = Future Dollar Value
i = Inflation Rate
n = Number of Years in the Future

Under this equation, if inflation is 4 per cent per year:

$$\mathbf{CDV\ in\ Year\ 1} = \frac{\mathbf{1{,}000}}{\mathbf{(1 + 0.04) \times 1}}$$

$$= \mathbf{961.54}$$

The escalation rate of energy costs can be different than inflation and will modify the Future Dollar Value. Multiply the current costs by the price escalation rate to get the Future Dollar Value. Be sure to take each year's rate into account.

Let's consider the previous example of a $28,000 investment with annual energy savings of $5,600. Energy costs escalate at 5 per cent and inflation is at 4 per cent. Table 3.2 shows the cash flow and cumulative cash flow in constant year zero dollars. In year zero, $28,000 is taken from capital reserves to pay for the project.

Table 3.2 - Constant Dollar Value: capital reserves

Year	Energy savings	Net annual cash flow constant ($)	Cumulative cash cash flow constant ($)
0	00.00	-28,000.00	-28,000.00
1	5,653.85	5,653.85	-22,346.15
2	5,708.21	5,708.21	-16,637.94
3	5,763.10	5,763.10	-10,874.85
4	5,818.51	5,818.51	-5,056.34
5	5,874.46	5,874.46	818.12
6	5,930.94	5,930.94	6,749.07
7	5,987.97	5,987.97	12,737.04
8	6,045.55	6,045.55	18,782.59
9	6,103.68	6,103.68	24,886.26
10	6,162.37	6,162.37	31,048.63

Energy savings in constant dollar values are based on the formula $5{,}600 \times [(1 + 0.05)^n / (1 + 0.04)^n]$ where n = year number. For example, in year 3, the energy savings based on the escalating energy costs of 5 per cent and inflation at 4 per cent will be:

$$5{,}600 \times [(1 + 0.05)^3 / (1 + 0.04)^3] = 5{,}763.10$$

Cash flow payment in year zero represents the purchase price.

This analysis indicates a positive cumulative cash flow in constant dollar occurs in year five. There is a positive net annual cash flow in all years after year zero, when the project was initially paid.

Consider the following example, which is simplified to deal in current year dollars and does not take inflation, opportunity costs nor return on investment into account.

In reality, this simplified analysis is the way most rink and arena operators or managers would analyze an investment. The example looks at borrowing money for the project from a financing institution that requires a payment of interest on the money borrowed. It assumes that the owner borrows 80 per cent of the $28,000 investment amount in Example 3.3, at 12 per cent interest rate charge, 5 per cent escalation on the cost of energy and $5,650 annual energy savings. The current dollar value of this investment is represented in Table 3.3. The dollar values represented are not discounted to constant dollars.

Table 3.3 - Constant Dollar Value: energy rate escalation

Year	Bank payment Current($)	Energy savings Current($)	Net annual cash flow Current($)	Cumulative cash flow Current($)
0	5,600.00	00.00	-5,600.00	-5,600.00
2	6,213.98	5,880.00	-333.98	-5,933.98
3	6,213.98	6,174.00	-39.98	-5,973.96
4	6,213.98	6,482.70	268.72	-5,705.24
5	6,213.98	6,806.84	592.86	-5,112.39
6	6,213.98	7,147.18	933.20	-4,179.19
7		7,504.54	7,504.54	3,325.35
8		7,879.76	7,879.76	11,205.11
9		8,273.75	8,273.75	19,478.86
10		8,687.44	8,687.44	28,166.30
11		9,121.81	9,121.81	37,288.11
	$36,669.90	**$73,958.02**	**$37,288.12**	**$66,958.97**

Payments in year zero represent the down payment. In year three, the installation begins to show a positive net annual cash flow. The cumulative cash flow is not positive until year six.

The table shows that to finance a $28,000 purchase, you paid $36,669.90 to the bank and saved $73,958.02 in energy costs, resulting in a total saving of $37,288.12. All values are in current dollars.

With both capital funded and financed project funding, the cumulative cash flow is not positive until year five or six.