

# Life-Cycle Cost Analysis Versus Simple Payback

## Why? When? How?

You want to make the best financial decisions on new equipment, operational improvements and new construction. You can make sure you get the most out of your investments by having a full understanding of the potential costs and attainable savings.

For relatively less expensive, simpler projects and measures, calculating the simple payback (SPB) can be enough to make a sound decision. SPB is how long it will take for cumulative energy savings and other benefits to equal or “pay back” your initial investment. It is calculated by dividing the dollar cost of the project by the dollar benefits.

But for more costly and complicated investments, doing a life-cycle cost analysis (LCCA) is necessary to make a sound decision as we’ll explain below. As the term implies, LCCA is a financial decision-making method that considers first cost, and all costs and benefits over the lifetime of the project. This is also called a “total cost of ownership” approach. It is powerful, worth learning and relatively simple to understand.

Below are the advantages and disadvantages of each.

### **Advantages of Simple Payback:**

- A simple way to screen relatively low-cost measures based on payback (or return on investment [ROI], which is 1 divided by the simple payback)
- Easier to communicate to a non-technical audience

### **Disadvantages of Simple Payback:**

- You can't compare complex projects and measures where costs and savings vary in both magnitude and timing (e.g., a condensing boiler and a standard boiler).
- Does not account for benefits and costs after the equipment has been paid back, so it can disadvantage projects with long useful lives (e.g., a high efficiency chiller with a 20-year life).
- It does not account for (1) maintenance, interest on loans and disposal costs; (2) time value of money, and; (3) volatility of utility costs.
- It can actually make economically sound improvements and project efficiency look economically unviable! We provide an example below.

### **Advantages of LCCA:**

- Helps you compare projects “apples to apples” financially even if they have different timing and magnitude of costs and savings.
- Provides you with a more complete financial picture by considering first cost, and all costs and benefits over the entire lifetime of the project.
- Enables you to compare different combinations of measures and choose the one that will maximize your savings and financial return.
- Allows you to present the financial benefits of your proposal in terms used by your CFO — for example, net present value (NPV), internal rate of return (IRR) and cash flows.
- Reduces your investment risk by projecting a more complete picture of the future.

### **Disadvantages of LCCA:**

- Is harder to learn and apply.
- Getting input data can be challenging.

## **Simple Payback versus Life-Cycle Cost Analysis: An Example**

Figure 1 compares the savings for a small and a large energy-efficiency project, both with 20-year lives.

The small project costs \$200,000 and saves \$100,000 annually (two-year simple payback) for five years before an additional investment of \$200,000 is needed.

The large project costs \$700,000 and saves \$184,000 annually (3.8-year simple payback) for 20 years, with replacement costs of \$200,000 every five years.

Which is a better investment?

Based on simple payback, the smaller project looks better. The larger project generates significantly more savings but the savings are in the future. Is it worth the investment?

Life-cycle analysis can transform these future savings into today's dollars using the concept of "time value of money." At a 7% discount rate and a 3% inflation rate, the smaller project saves only \$550,000 in today's dollars, while the large project saves \$1,400,000! **Would you pass up \$850,000?**

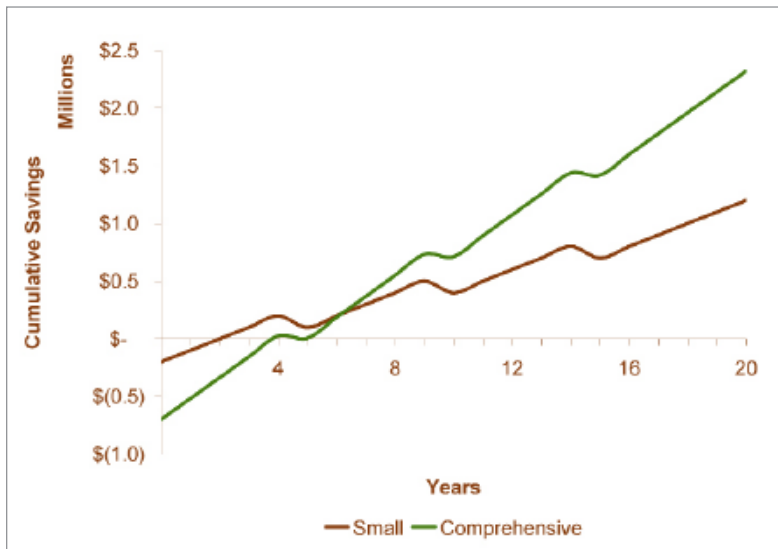


Figure 1

## When to Use LCCA versus Simple Payback

Here is a simple decision table for which to use:

Below is a table of equipment common to hospitals and general guidelines for whether simple payback or life-cycle cost analysis is a good financial decision method.

Simple Payback Analysis	Life-Cycle Cost Analysis
First cost relatively small for your budget.	First cost relatively high for your budget.
Only one substantial life-cycle cost (e.g., electricity).	Many life cycle costs (e.g., electricity, gas, water, maintenance, etc.).
Fairly even annual cash flow.	Substantial variation in annual cash flow.
Simple equipment comparison (e.g., high efficiency roof-top AC unit vs. "code-minimum" unit).	Projects where one decision impacts others (e.g., daylighting/shading allows a smaller central plant).
Installation of "off the shelf" equipment.	Projects involving significant project design work.

Equipment	Financial Decision Method
<ul style="list-style-type: none"> <li>• Linear Fluorescent Lamps</li> <li>• Compact Fluorescent Lamps</li> <li>• Electronic Fluorescent Ballasts</li> <li>• Exit Signs</li> <li>• Lighting Controls</li> <li>• Lighting Fixtures</li> </ul>	Simple Payback (SPB) analysis enough unless part of one or more packages of measures being analyzed. (Note: most utilities offer generous incentives)
<ul style="list-style-type: none"> <li>• Water-cooled Chillers and Cooling Towers</li> <li>• Air Filters</li> <li>• Sterilizer Economizers</li> <li>• Hot Water Boilers</li> <li>• Domestic Hot Water Heaters</li> </ul>	Life-Cycle Cost Analysis (LCCA). Consult with vendors on inputs for analysis.

Equipment	Financial Decision Method
Variable Frequency Drives (VFDs)	N/A – savings come from how VFDs are applied, not differences in the VFDs themselves.
Computers and Power Supplies	No analysis necessary. Simply buy ENERGY STAR®.
Network-level Computer Controls (ask vendor how justified)	LCCA – consult with vendor on inputs for analysis.
Televisions	SPB
Printers, Fax Machines, Copiers	No analysis necessary. Simply buy ENERGY STAR.
Ice Machines (prescriptive — ENERGY STAR)	No analysis necessary. Follow FEMP guidelines.
Refrigerators and Freezers	No analysis necessary. Simply buy ENERGY STAR.
Beverage Vending Machines	Ask your vendor about efficiency and purchase cost.
Medical Equipment	N/A – Savings come from where located and how integrated into facility. No ENERGY STAR-rated equipment.

## Hurdle Rates

Financial “hurdle” rates for energy-related investments/purchases can help guide funding decisions. For example, fluorescent lamp purchase might be based on simple payback of a certain length. But the purchase of large and complex pieces of equipment like a chilled water system should be based on the Internal Rate of Return (IRR) determined by LCCA.

Whether SPB or LCCA is used, hurdle rates should be based on all significant costs and benefits – the total cost of ownership – not just energy. For example, a piece of equipment may be energy efficient, but if it has a relatively short lifetime compared to its standard counterpart, the costs of periodic replacement (equipment and labor) may make the efficient model less economic.

Below are examples of financial hurdles that other organizations have used to decide whether to make an energy-related investment:

- **Example Hurdle Rate:** For items with a short lifetime (e.g., 5 years or less) and an initial cost of \$500 or less, do a simple payback analysis and make the investment/purchase if the simple payback is 5 years or less.
- **Example Hurdle Rate:** For items with a long lifetime (e.g., 10 years or more) and/or an initial cost of \$10,000 or more, do a life-cycle cost analysis and make the investment/purchase if it has an IRR of 10% or better.