Monetizing Energy Solutions

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ABSTRACT

Potential energy efficiency solutions are routinely identified by commercial and industrial energy programs across North America. While these recommendations can be impressive for their technical content, they often have disappointing implementation rates. One reason may be a failure to accurately demonstrate the business performance of these improvements. Such a discussion would require thinking of energy efficiency improvements not as "projects," but as investments.

Investment analysis seeks capital recovery as its goal. In simple terms, *capital recovery* is the result of wealth creating wealth; it describes how well assets work at creating new income. The fundamental metric for capital recovery measurement is the *rate of return on capital*. But that's not all. Rates of return can also describe the destruction of wealth. This is exactly what happens when a proposed investment in energy efficiency is rejected, allowing energy waste to accrue. The result is capital recovery in reverse.

Rates of return are used to measure the investment performance of most assets, including stocks, bonds, and mutual funds, as well as the cost of borrowing money. However, custom dictates that energy efficiency proposals are evaluated by simple payback, even for recommendations that involve thousands or even millions of dollars. When corporations ponder their capital investment options, proposals that rely on simple payback measures may be at a disadvantage because their performance is not measured by the same yardstick used for other investment opportunities. Think of it this way: Who evaluates a mutual fund's performance by its simple payback?

This discussion uses a realistic energy improvement proposal to seek clarity on a few points: What's wrong with simple payback? And if rates of return are a better tool, can that be proven? How can the economic and

financial performance of energy efficiency investments be demonstrated? By the way, what's the difference between economic and financial justification? What exactly are the financial consequences of ignoring energy improvements? This article will pursue all of these questions. The findings should assist anyone who attempts to demonstrate the investment value of energy improvements, therefore convincing more business leaders to accept energy solutions of all description.

WHY IS SIMPLE PAYBACK NOT SUFFICIENT?

Today, it is still customary to describe the benefits of energy efficiency in terms of *simple payback*, that is, the number of years that it takes for an investment to "pay for itself" through the annual benefits that it generates. This metric is almost universally recognized and understood, but that doesn't mean that it is truly informative. Simple payback almost completely fails to answer the questions which an astute business investor would ask:

- **What is the magnitude of benefits offered by the investment**? Simple payback offers no mechanism for evaluating benefits that accrue after the investment has paid for itself; therefore, some portion of the total benefits is ignored.

- **How quickly do those benefits accrue?** Payback is a measure of time. It fails to measure the magnitude of new wealth created from invested capital. Knowing the payback of a certain project tells you nothing about the cost of obtaining investment capital. It does not compare the project's returns to the profitability of the overall business, nor does it compare the project returns to those provided by alternative investment opportunities such as stocks, bonds, or mutual funds.

- **What is the risk of making this investment?** Payback is useful, to some extent, as a relative measure of investment risk. The quicker the payback, the less the risk. Its usefulness is limited because the calculated result is an instantaneous measure ("payback is X years"). The magnitude of wealth created by a productive asset grows with each successive year of its operation. As an instantaneous measure, payback fails to describe this trend. The internal rate of return (IRR) is a dynamic function that varies consistently across a range of years. It provides a more complete and flexible interpretation of investment performance.

- **What is the risk of *not* making this investment?** Simple payback helps the investor to decide whether or not to walk away from the proposed investment. In other words, if the calculated payback does not meet a prescribed threshold, the project is rejected. Unfortunately, in the case of energy efficiency improvements, walking away is not an option. The investor will outlay cash in either case—to pay for the energy efficiency upgrade, or to pay for excess energy that will be wasted. Simple payback provides no information about the cost of doing nothing.

- **How does this investment compare to other ways of using the investment capital?** The investor always has alternatives to investing in energy efficiency projects. Whether it is a stock, bond, mutual fund, or an investment in the investor's own core business, each alternative delivers some rate of return. Simple payback is helpful only for choosing whether to accept or reject a certain proposal. However, because it does not measure rates of return, simple payback fails to allow comparisons with other investment opportunities.

CAPITAL INVESTMENT GOALS

Industrial owners seek wealth by investing their equity in a business enterprise. When doing this, the investor strikes a balance between the speed and magnitude of investment returns. This balance influences the firm's management strategy. On the one hand, the highest possible returns may be gained in the short run by quickly exhausting the existing assets. (Recall the parable about the goose that laid golden eggs?) An alternative management approach seeks somewhat lower yet more durable returns from long-term, sustainable operations. Companies that conduct annual capital investment programs adopt the latter approach, seeking optimized returns through investments that grow the firm's capacity to create wealth.

Rates of return are distilled from cash flow data that describe business performance. To properly interpret this data, a review of cash flow fundamentals is in order.

THE BIG PICTURE: CASH FLOW FUNDAMENTALS

The wealth used to form a business should generate new wealth; that is the purpose of a business. *Capital recovery* describes the creation of new wealth (cash flow) from existing capital. Specifically, a business venture is obligated to achieve superior rates of capital recovery relative to other investment alternatives. While capital recovery is illustrated by a rate of return, the magnitude of returns is measured by cash flow. Performance metrics for the business in its entirety are the benchmarks by which incremental investments are measured.

The stages of a business process have incremental impacts on cash flow. In an industrial organization, cash flow is shaped first by operations that convert inputs into final products, then by the impact of depreciation and taxes, and finally by the payment and receipt of interest related to capital finance. Cash flows are tabulated periodically in financial statements. These statements provide data that become benchmarks for investment performance. A sample consolidated financial statement for the hypothetical XYZ Company illustrates this in Table 1.

The investment benchmarks for XYZ Company include:

Return on Equity (ROE). Equity describes the wealth that investors commit to a business firm. For capital investment analysis, ROE is an intermediate measure which contributes to the rate of capital recovery. ROE is after-tax net income divided by total equity.

$$\text{ROE} = \frac{\text{Net Income}}{\text{Total Equity}} = \frac{\$6{,}250{,}000}{\$60{,}000{,}000} = 10.4\%$$

Long term cost of debt. Another intermediate component of the capital recovery rate is the cost of long-term debt financing. Debt represents capital loaned to the business to grow its asset base. The cost of this debt is measured by the annual interest expense divided by the value of long-term liabilities (debt).

$$\text{Cost of Long-Term Debt} = \frac{\$1{,}600{,}000}{\$20{,}000{,}000} = 8.0\%$$

Table 1. Consolidated Financial Statement, XYZ Company

BALANCE SHEET, December 31, 20XX		
CURRENT ASSETS..................................		$10,000,000
LONG-TERM (L-T) ASSETS.........................		$80,000,000
TOTAL ASSETS......................................		**$90,000,000**
CURRENT LIABILITIES..............................		$10,000,000
LONG-TERM LIABILITIES..........................		$20,000,000
TOTAL LIABILITIES.................................		**$30,000,000**
EQUITY..		**$60,000,000**
TOTAL CAPITALIZATION...........................		**$90,000,000**
INCOME STATEMENT, Jan. 1, 20XX – Dec. 31 20XX		
	REVENUES.................	$100,000,000
Less	OPERATING EXPENSES......	$92,000,000
	OPERATING INCOME.........	**$8,000,000**
	DEPRECIATION..................	$3,000,000
	TAXABLE INCOME.............	**$5,000,000**
Adjust for	TAXES @ 35%.......................	$1,750,000
	NET INCOME.....................	**$6,250,000**
Subtract	INTEREST EXPENSE..........	($1,600,000)
	FREE CASH FLOW.............	**$4,650,000**

Weighted Average Cost of Capital (WACC). This measure blends the interest cost on long-term debt with the cost of equity (ROE). The balance sheet (Table 1) shows that liabilities represent 33.3% of total capitalization; equity represents the remaining 67.7%. Note that interest paid on borrowed capital is tax-exempt. For that reason, the interest rate on borrowed capital is modified by a tax correction factor (1-marginal tax rate). WACC measures the firm's current overall rate of return on invested capital or, in other words, the firm's capital recovery performance. The WACC for XYZ Company is:

$$\text{WACC} = (.677 \times 10.4\%) + [(.333 \times 8.0\%) \times (1\text{-}35\%)] = 8.7\%$$

Note the cash flow stages shown in the income statement (lower portion of Table 1). Each stage has a specific audience and purpose. These stages are relevant both to business performance and to individual investment evaluation.

- **Operating income is the measure of operating performance.** Operating performance measures how well inputs are being managed for revenue creation in any specific time period, prior to the impact of taxes and debt service. Operating income is the result of subtracting operating expenses (typically including labor, materials, general and administrative costs, depreciation, and energy and other utilities) from revenue. Operating income is measured by current year activity, as reflected in the current year's operating budget.

- **Net income is a measure of economic performance.** Net income is operating cash flow adjusted for the impact of income tax, which is in turn derived from income adjustments due to depreciation charges. Net income is the relevant measure of new wealth to be evaluated for capital recovery performance. When net income is discounted (reduced) by the WACC, the amount of the reduction represents capital recovery. Any remainder represents new value created. This is the essence of economic analysis—identifying investments that return value in excess of existing capital returns. In other words, a firm that currently achieves a capital recovery rate of 8.7% should pursue any new investment that provides an after-tax rate of return in excess of 8.7%, if the investor's goal is to grow the business.

- **Free cash flow indicates financial performance.** Free cash flow is the value that remains after any debt service that may be issued to repay borrowed capital. Therefore, financial performance reflects the outcome of business leverage, or in effect, the ability to "use other people's money." If the business experiences no debt service, free cash flow is equal to net income.

These metrics describe the big-picture performance of the firm in its entirety. Economic investment analysis evaluates proposed asset performance relative to this big picture. While the worthiness of investment proposals is an economic question, the firm's actual commitment to any one proposal depends on the terms of project finance. What may be a "good" investment per its economic performance may not be good (have adequate profitability) if the lender's financing terms are not suitable.

RATE OF RETURN: AN INVESTMENT EXAMPLE

The investment performance measures distilled from the income statement, as described above, are useful—if used correctly. The prevailing custom is to evaluate a proposal by its simple payback; for example:

Cost:	$1,000,000
Annual energy savings:	$250,000
Simple payback:	4 years
Investor's payback criterion:	2 years or less
Investor's conclusion:	*Reject the proposal*

Note that this analysis is entirely rooted in *operating results*, that is, before the impact of taxes and finance. The analysis and outcome described above makes sense in light of the firm's organizational politics, if not its financial goals. From a responsibility standpoint, operating performance is "owned" by middle managers who track costs and budget-to-actual comparisons. Middle management job performance is cost center performance—which in turn is shaped by the pre-tax and pre-finance parameters of an annual operating budget. For these managers, budgets and calendars are more important than profit. Note that energy investments are perceived as "technical" choices that most corporate leaders will gladly delegate down to engineers and facility managers, for whom profitability (measured by rates of return) is virtually irrelevant. Remember that simple payback (project cost divided by its annual energy savings) relies entirely on operating performance data. Because it is a calendar-driven measure, simple payback is the natural (if ill-chosen) investment metric of choice for the middle managers who are responsible for energy project choices.

Most of the variables needed for a robust financial analysis are omitted from simple payback calculations. Keep in mind that the investor has other investment opportunities, both internal and external to the firm. So how does this proposal compare to all others? To answer this, we need to compare this proposal's rate of return to the rates offered by all other relevant options. This analysis requires more data, as shown in Table 2.

Assuming XYZ Company's commitment to sustained business growth, capital investments should then be evaluated for two, sequential criteria—economic and financial.

1. **Economic**: Will the proposal grow (or at least sustain) the business? If so, the proposal must offer economic performance equal to or better than the firm's current 8.7% rate of capital recovery.

Table 2. Investment Proposal Data

TOTAL CONSTRUCTION BUDGET:	$1,000,000	In addition to equipment costs, the construction budget may include engineering and consulting fees, the net salvage value of old equipment being replaced, and various rebates or incentives.
ANNUAL ENERGY SAVINGS:	$250,000	A four-year payback!
ECONOMIC LIFE OF THE PROPOSED ASSET:	10 years	Economic life usually reflects the physical service life of the asset.
PERCENT OF TOTAL CONSTRUCTION BUDGET TO BE FINANCED:	80%	This percentage is unique to every project, and reflects management discretion.
PROJECT FINANCE AMORTIZATION:	7 YEARS	This is the length of time established by the lending agreement that finances the project.
ANNUAL PERCENTAGE RATE FOR FINANCE:	5%	This is the rate of return required by the lender.
DEPRECIATION PROPERTY CLASS:	39 YEARS	This is the number of years over which an asset value is relegated to operating expense. In the U.S., energy-consuming stationary mechanical systems powered by non-renewable energy sources are depreciated over 39 years. Since this asset has a 10-year economic life, there will be a balance of un-applied depreciation which manifests as a book loss (and a large tax benefit) in year 10.
MARGINAL TAX RATE APPLIED TO INCOME:	35%	Taxes are applied to annual operating income MINUS the annual depreciation and book loss charges.
ECONOMIC RATE OF CAPITAL RECOVERY:	8.7%	This is the rate of return needed to at least sustain current business performance. At a minimum, this is the average rate of return earned on the business' assets in recent years.
BEST ALTERNATIVE INVESTMENT RATE OF RETURN:	2.9%	Let's say the owner's best alternative to investing in the business is to purchase shares in a Vanguard S&P 500 mutual fund, which has returned 2.9% per annum over the last decade.
INDUSTRY ANNUAL GROWTH RATE:	10%	Firms should grow at this rate to remain competitive in the industry.

2. **Financial**: Are the terms of project finance beneficial? Profitability is evidenced by total benefits in excess of their cost. The relevant measure for financial performance is free cash flow. Because it is a post-finance measure, free cash flow includes any investment down payment (an initial cash outlay) as well as the future cash that remains after debt service and its tax consequences.

To advance this discussion, consider the cash flow results for a specific energy efficiency investment considered by the hypothetical XYZ Company, shown in Table 3.

This investment can be described by its profitability index (PI), where:

$$\text{Profitability Index} = \frac{\sum \text{Discounted Value of Project Benefits}}{\sum \text{Discounted Value of All Project Investments}}$$

A "good" investment is one with a PI of 1.0 or better. The profitability index is dynamic over a range of years—as the economic life of the project expands, more annual benefits are realized, and the compounded rate of return grows accordingly. So how well does the subject proposal perform as an investment? A profitability index is based on cumulative discounted cash flow results through year "t," derived from Table 3 and shown in Table 4.

The profitability of this investment ramps up with each additional year of net income derived from energy savings. This proposal describes an asset that recovers its investment value, properly adjusted for taxes and the cost of capital, by year eight (when PI achieves unity). After that, the investment creates new wealth. The PI metric in Table 4, column D would derive its numerator from the net present value of the cash flow shown in column B. The denominator is derived from column A. Both cash flows are discounted using the firm's WACC of 8.7%. The results over the project's 10-year economic life are:

$$\text{Profitability Index} = \frac{\$1{,}228{,}153}{\$1{,}000{,}000} = 1.2 \text{ in year } 10$$

Specifically, this investment creates new wealth equal to $228,153 in today's dollars. The downside of this proposal is that the asset takes eight years to reach parity (where PI = 1.0).

Table 3. Cash Flow for a Specific Energy Proposal

	OPERATING PERFORMANCE				ECONOMIC PERFORMANCE				
A	B	C	D	E=C+D	F	G	H=E-F	I=(H-G)*tax	J=H-I+F
YEAR	NOMINAL INVESTMENT	NOMINAL ENERGY SAVINGS	NOMINAL O&M COST CHANGE	OPERATING INCOME & SALVAGE	DEPRECIATION CHARGE	BOOK LOSS	TAXABLE INCOME	INCOME TAX 35.00%	NET INCOME
0	-$1,000,000				$0				
1	$0	$250,000	$0	$250,000	$25,641	$0	$224,359	$78,526	$171,474
2	$0	$250,000	$0	$250,000	$25,641	$0	$224,359	$78,526	$171,474
3	$0	$250,000	$0	$250,000	$25,641	$0	$224,359	$78,526	$171,474
4	$0	$250,000	$0	$250,000	$25,641	$0	$224,359	$78,526	$171,474
5	$0	$250,000	$0	$250,000	$25,641	$0	$224,359	$78,526	$171,474
6	$0	$250,000	$0	$250,000	$25,641	$0	$224,359	$78,526	$171,474
7	$0	$250,000	$0	$250,000	$25,641	$0	$224,359	$78,526	$171,474
8	$0	$250,000	$0	$250,000	$25,641	$0	$224,359	$78,526	$171,474
9	$0	$250,000	$0	$250,000	$25,641	$0	$224,359	$78,526	$171,474
10	$0	$250,000	$0	$250,000	$25,641	$743,590	$224,359	-$181,731	$431,731

Table 4. Profitability Index

	A	B	C	D
YEAR$_t$	ANNUAL INVESTMENT	NET INCOME	NET INCOME ADJUSTED FOR CAPITAL RECOVERY	PI
0	$1,000,000			
1	$0	$171,474	$157,750	0.2
2	$0	$171,474	$145,124	0.3
3	$0	$171,474	$133,509	0.4
4	$0	$171,474	$122,823	0.6
5	$0	$171,474	$112,993	0.7
6	$0	$171,474	$103,949	0.8
7	$0	$171,474	$95,630	0.9
8	$0	$171,474	$87,976	1.0
9	$0	$171,474	$80,934	1.0
10	$0	$431,731	$187,464	1.2

But consider this: an *unprofitability index* (UPI) describes the consequences of refusing the energy efficiency improvement. The logic is that *continued energy waste contributes to negative capital recovery and its deleterious effect on income*. Unprofitability is purely an economic measure, because if the proposed project is rejected, there is no depreciation and no cost of lender finance. The result is a cash flow loss. For evidence of this capital destruction, look no further than the monthly checks written to the energy supplier. If capital is not invested in an energy improvement, then it can be thought of as an asset called *deferred expense*. UPI is a ratio that compares the investment capital amount (denominator) to the negative net income waste that it could have eliminated (numerator). The calculation is:

$$\text{Unprofitability Index} = \frac{\sum \text{Discounted Value of Net Income Waste}}{\sum \text{Discounted Total Rejected Investment Value}}$$

The relevant cash flows for the unprofitability index are shown in Table 5, where the numerator of the unprofitability index is the net present value (NPV) of column D. The denominator is the NPV of column A. Again, this index is based on cumulative discounted cash flow results through year "t." Discounting is achieved using the firm's current rate of capital recovery, 8.7%:

$$\text{Unprofitability Index} = \frac{\sum \text{Discounted Value of After-Tax Economic Waste}}{\sum \text{Discounted Value of Nominal Investment Outlays}} = \frac{-\$1{,}056{,}783}{\$1{,}000{,}000} = -1.1$$

Table 5. Unprofitability Index (UPI)

	UNDISCOUNTED				DISCOUNTED	
	A	B	C	D	E	F
YEAR	REJECTED NOMINAL INVSTMNT OUTLAYS	OUTLAY FOR ENERGY WASTE (BEFORE TAX)	35.00% TAX IMPACT	AFTER-TAX NET INCOME WASTE	NET INCOME ADJUSTED FOR CAPITAL RECOVERY	UPI
0	$1,000,000					
1	$0	-$250,000	$87,500	-$162,500	-$149,494	-0.1
2	$0	-$250,000	$87,500	-$162,500	-$137,529	-0.3
3	$0	-$250,000	$87,500	-$162,500	-$126,522	-0.4
4	$0	-$250,000	$87,500	-$162,500	-$116,395	-0.5
5	$0	-$250,000	$87,500	-$162,500	-$107,079	-0.6
6	$0	-$250,000	$87,500	-$162,500	-$98,509	-0.7
7	$0	-$250,000	$87,500	-$162,500	-$90,625	-0.8
8	$0	-$250,000	$87,500	-$162,500	-$83,371	-0.9
9	$0	-$250,000	$87,500	-$162,500	-$76,699	-1.0
10	$0	-$250,000	$87,500	-$162,500	-$70,560	-1.1

The unprofitability index (UPI) is negative, since the cash flow (after-tax economic waste) is negative. This is capital recovery in reverse! Also, over the 10-year time dimension, the absolute magnitude of the unprofitability index ranges from 0.1 (year 1) to 1.1 in the tenth year.

When the UPI is below parity (years 1-8 in Table 5), the $1 million investment value is being drawn down by the energy waste. Once the UPI exceeds parity in year nine, the $1 million retained investment value has been totally expended through energy waste. That waste begins to destroy the firm's remaining assets from year nine. To avoid capital destruction, the firm needs to invest in this energy improvement. If the capital is to be directed elsewhere, the alternative investment must provide a rate of return high enough to match the firm's overall rate of capital recovery *plus* compensate for the capital destruction due to this proposal's rejection. Just for the record, the capital destroyed by the 10-year energy waste, over and above the retained $1 million, is $56,783 (the net present value of Table 5's column D). To compensate for energy waste, the firm needs to commit its $1 million to an alternative investment that provides an internal rate of return of 10% or better. Why? Because the internal rate of return is 10% on an investment of $1 million that returns an undiscounted $162,500 annually for ten years. By choosing to reject the energy efficiency proposal, the firm must live with the capital destruction caused by that waste. In order to remain "whole," the alternative investment's rate of return must exceed 10%. Any investments with a rate of return between 8.7% and 10% are now unsuitable. With higher rates of return comes the volatility of higher investment risk. By purposely sustaining its energy waste, the firm commits itself to incrementally higher risk and volatility of investment performance.

WHAT ABOUT OTHER INVESTMENT OPPORTUNITIES?

Individual investments can be compared by their internal rate of return. IRR describes the annualized effective compound rate of return realized by an investment over its lifetime. Stated differently, IRR measures "how hard" an investment works at creating wealth. Therefore, the priority placed on any investment proposal varies directly with that project's internal rate of return. IRR allows the investor to critically evaluate the investment performance of dissimilar alternatives, such as stocks, bonds, and mutual funds. A good energy efficiency investment should offer a rate of return superior to the best of these alternatives. A financial analysis evaluates the bottom line cash flows after adjusting investment returns for depreciation, taxes, and third-party finance. All that is left is free cash flow. The results for the energy improvement proposed to XYZ Company are shown Table 6, where column A, "net income," is the after-tax value of energy savings.

Internal rate of return is dynamic; it grows with each additional year's returns. Because of finance, the investor's initial outlay is only 20% of the total project cost. After paying debt service, the returns are still sufficient to yield a positive free cash flow. (See Table 6, column H.) Note that the use of debt finance accelerates the rate of return. The profitability index reached parity in year 8. (See Table 4.) Here (Table 6), IRR on free cash flow becomes positive in year five, surpasses the firm's weighted average cost of capital (8.7%) in year six, and returns 29% overall through 10 years. By the way, one alternative was to put the money in an S&P 500 index mutual fund—which returned a mere 2.9% per annum over the last 10 years. (See Table 2.)

CONCLUSION: PUTTING IT ALL TOGETHER

Recall that the hypothetical investment proposal presented here provided a four-year simple payback. If the investor required a payback of two years or less, this proposal would be dismissed. But at what cost? The findings from this discussion answer the questions of the astute investor, as posed at the beginning:

What is the magnitude of the benefits offered by this project? Over its 10-year life, this investment generates a present value of $228,153 in excess of its cost. This is after properly accounting for depreciation, taxes, and the cost of capital.

How quickly do those benefits accrue? The investment capital is fully recovered in year nine, when evaluated by the firm's own rate of capital recovery. This is a 21% rate of return. Note, however, that third-party finance accelerates the returns. Under the current lender's terms (80% of value financed at 5% compounded monthly for seven years), the IRR exceeds the firm's overall capital recovery rate in year six and provides a 29% rate of return through year 10.

What is the risk of making this investment? The investment risk is

Table 6. Internal Rate of Return on Free Cash Flow

	NET INCOME	LENDER'S FINANCE SCHEDULE END-OF-YEAR TOTALS, MONTHLY AMORTIZATION				TAX SAVINGS ON INTEREST	AFTER-TAX CASH OUTLAY	FREE CASH FLOW	IRR
		PAYMENT	INTEREST	PRINCIPAL	BALANCE				
YEAR	A	B	C	D	E	F	G	H	I
0		-$200,000			$800,000		-$200,000	-$200,000	
1	$171,474	-$135,686	$37,776	$97,909	$702,091	$13,222	-$122,464	$49,011	NA
2	$171,474	-$135,686	$32,767	$102,918	$599,173	$11,469	-$124,217	$47,257	-38%
3	$171,474	-$135,686	$27,502	$108,184	$490,989	$9,626	-$126,060	$45,414	-16%
4	$171,474	-$135,686	$21,967	$113,719	$377,270	$7,688	-$127,997	$43,477	-3%
5	$171,474	-$135,686	$16,149	$119,537	$257,734	$5,652	-$130,033	$41,441	4%
6	$171,474	-$135,686	$10,033	$125,652	$132,081	$3,512	-$132,174	$39,300	9%
7	$171,474	-$135,686	$3,604	$132,081	$0	$1,262	-$134,424	$37,050	12%
8	$171,474	$0	$0	$0	$0	$0	$0	$171,474	20%
9	$171,474	$0	$0	$0	$0	$0	$0	$171,474	24%
10	$431,731	$0	$0	$0	$0	$0	$0	$431,731	29%

embodied in the timing of cash flows. If the investor in committed to the business for the long term (certainly more than nine years), this investment is imperative. But if the owners intend to abandon the business (writing off the assets) at any time within the next nine years, then they should not make this investment. In that scenario, the owners commit to running the assets into the ground without improvement—"killing the goose" to get all the golden eggs now, at the expense of long-range returns. However, a more likely plan for divestiture is to sell the assets to a new owner / management team. If so, the current owners will have improved the income-producing capacity of their facility by adding this project to their asset base. The buyers are likely to offer a price based on capitalized income. Because of the greater net income made possible by efficient energy use, the capitalized enterprise value will be that much higher.

What's the risk of *not* making this investment? The unprofitability index (Table 5) shows that rejection of this proposal results in destruction of the firm's capital, beginning immediately. The original $1 million investment value is depleted by year nine. By the end of year 10, an additional $56,783 of additional existing capital is destroyed. ("Destroyed" means income spent on avoidable energy waste instead of deposited as retained earnings.)

How does this investment compare to other ways of using the investment capital? We saw above that the owner's best alternative investment would be to purchase shares in a mutual fund that has returned a 2.9% compound annual return over the past decade. (See Table 2.) We recognize that "past performance does not guarantee future results"; however, the same admonition applies to the proposed project as well as mutual funds. The internal rate of return on the free cash flow (Table 6) is 29% over ten years.

How does this investment contribute to the competitiveness of the firm? Recall from Table 2 that this firm competes in an industry with 10% overall growth rates. The financial IRR calculation shows that this investment, if leveraged with the third-party finance terms described here, will exceed 10% in year seven. (See Table 6.) Once again, if the owners intend to remain invested in this firm through the 10-year economic life of this investment, they will enjoy an increase the firm's overall capital recovery performance.

Observations about simple payback. Recall that this $1 million proposal yielded $250,000 in annual operating savings, a four-year payback. After adjusting for depreciation and taxes, the payback is 5.8 years. Then, after discounting future cash flows at the weighted average cost of capital, the initial investment is not entirely recovered until year eight, when the profitability index achieves parity. (See Table 4.) Despite the discussion presented in this article, simple payback will continue in widespread use. *Care should be taken to communicate which cash flow is the basis for calculating payback*. Avoid the temptation to calculate payback on the free cash flow remaining after project finance, because finance amortization has imposed an artificial capital recovery structure that is relevant to the lender, not the investor. To understand this, see Table 6, column H. A naïve calculation shows *simple payback* of the free cash flow occurring in year five, but in fact the investment capital is amortized over seven years and by definition is fully recovered over seven years.

A final note: all the results described above assume that energy prices will remain flat over the 10-year economic life of this investment. Each of these investment metrics will improve as energy prices rise (and/or as interest rates fall).

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