

Commissioning vs. Energy Audits: *Making the Best Choice for Your Facility?*

Gregory J. Hugel, LEED AP

The Environmental Protection Agency (EPA) states that about 30% of the energy consumed in office buildings is wasted¹, showing a great potential for energy reduction within existing facilities. There are many ways to reduce energy consumption; the two most discussed methods are commissioning and energy audits. How do you choose what is right for your facility? To help decide on the best course of action, it is important to understand the difference between the two and determine which one best fits into your organization's goals and plans.

Commissioning is performed to ensure that building systems are operating in accordance with facility requirements and design intent. Retro-commissioning is a type of commissioning that refers to existing buildings that have not been previously commissioned. For the purpose of this article, we will focus on existing buildings. Energy audits are performed to identify and develop projects that reduce energy consumption and/or cost of operating a building such as replacing old equipment with energy efficient equipment.

Commissioning

Commissioning is a good starting point when trying to operate your HVAC system at peak energy efficiency. In existing buildings, the process can provide your facility an annual energy savings anywhere between 5% and 20%². The process consists of testing the functionality of the building and confirming that the design intent is achievable. The primary benefits are improved energy efficiency, reduced utility costs, improved building indoor environmental quality, and a better understanding of the building's mechanical, plumbing, and electrical systems. The cost of retro-commissioning can appear shocking at first, typically ranging from \$0.27 to \$0.45 per square foot depending on building size, system type, age, and project complexity. However, the payback typically ranges from 0.5 to 2 years.

Energy Audits

Energy audits systematically identify and develop opportunities to help reduce energy consumption and therefore decrease building utility costs. Energy audits help to identify items such as older chillers or boilers that can be upgraded to more energy efficient models. Energy audits can also provide recommendations for optimizing the building's energy management system to assist in providing a balance between energy efficiency and occu-

pany comfort. Overall, an energy audit is a valuable tool for gaining a better understanding of how your facility operates, and it provides recommendations for optimizing building systems. An energy audit can help facility managers make educated decisions on determining the best ways to help reduce energy, reduce operating costs, provide more appropriate occupant comfort levels, and create a more efficient building. The cost of an energy audit typically ranges from \$0.08 to \$0.24 per square foot depending on building size, system complexity, and level of detail required. The payback period of an energy audit typically ranges from 0.5 to 4 years.

Both commissioning and an energy audit allow you to gain a better understanding of your building's systems and operation. Both will help you improve the operation of your building and lead to a decrease in energy consumption and operating cost. What's the difference? *Commissioning is a process requiring testing and performance validation, while energy audits tend to be singular events.* What makes energy audits most attractive is the relative speed with which they can be accomplished and their correspondingly low first cost in comparison to commissioning. The attraction to commissioning is the long term benefits of an implemented continuous improvement program.

If your facility wants to quickly tighten up its operation and is looking for low-cost/no-cost opportunities while still receiving suggestions for energy efficient equipment replacement, then an energy audit may be the path that is best for your facility. If you're looking to dive more into the details of your building's operation and are willing to spend the time and money to fine tune your facility, then commissioning may be the better option. If you're unsure of the level of commitment you are willing to invest in, then a preliminary walk-through energy audit that identifies only the low cost/no cost improvements may be a good starting point.

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1 www.epa.gov

2 Lawrence Berkeley National Laboratory. 2005. Costs and Benefits of Commissioning New and Existing Commercial Buildings. Mills, Evan; Bourassa, Norman; Piette, Mary Ann et al. U.C. Santa Cruz



Facility Facts

Facility Engineering Associates Informational Newsletter

Commissioning vs. Energy Audits *Continued from page 1*

You will only get out of a building what you put into it. Having an in-depth understanding of your building will allow you to put in place the proper measures to help optimize your efforts and money. Performing commissioning and/or an energy audit of your facility will help identify any issues and problems with the building and keep your systems running properly. Determine your facility goals, target the best method for achieving these goals, and get on the path to better performance!

For more information on this topic, please contact Gregory Hughel at (703) 591-4855 or greg.hughel@feapc.com.

	Energy Audit	Commissioning
Walk-through Survey	✓	
Energy Use Breakdown	✓	
O&M Practices Review	✓	✓
Utility Consumption Review	✓	✓
Identify No-Cost/Low-Cost Measures	✓	✓
Identify Capitol Improvements Requiring Further Study	✓	
Identify Capitol Improvement Costs, Energy Savings and ROI	✓*	✓
Site Visit - Detailed Assessment	✓*	✓
Design Document Review	✓*	✓
System installation, operation & maintenance review	✓*	✓
System Sequence of Operation Testing		✓
System Functional Testing		✓
Data & Trend Logging		✓

**Provided on more detailed level energy audits*

Announcements and Accomplishments

FEA will be presenting at Greenbuild 2009 in Phoenix, AZ in November. Out of the 1,300 abstracts submitted, 112 were chosen; and we're very proud to say FEA was awarded two of those slots! *How the LEED-EB Certification Process Transforms Your Operations and Engages People: A Panel Discussion with Facility Managers and LEED APs* will be led by Teena Shouse, moderator and FEA Senior FM Consultant. Maureen Roskoski, FEA Senior Professional, Kim Dominquez from National Education Association, and Carlos Ocampo of VSP Vision Care will be panelists. Additionally, Chris Hodges, Principal, will be co-presenting with Sean Delehanty of BAE Systems on *Using a Room-by-Room Approach to Energy Curtailment and Greening at BAE Systems.*

FEA will be presenting at SRAPPA 2009 in Daytona Beach, FL in October! Mary Kate Toomey and Gregory Hughel will be co-presenting *Going Green While Staying Out of the Red: Tradeoffs*

and Payoffs of implementing Energy, Environmental, and Economic Solutions. And Laura Cavanaugh will be presenting *Greening Your Repair Project.*

FEA's Chicago Office Location has a new address!
2135 City Gate Lane, Suite 300, Naperville, IL 60563
Ph: (630) 780-1026 / Fax: (630) 689-1296

Katherine J. Powers, P.E. joined FEA's Fairfax office as a Project Manager. Kathy has more than 20 years of experience in facilities support contracting, facilities management, and project administration. She is a former U.S. Navy Civil Engineer Corps Officer and a past Department of Defense Contracting Office.

Patrick Jaschek has recently joined FEA's Chicago office as a Staff Engineer. Patrick is a graduate of Purdue University with a Bachelor's Degree in Civil Engineering.

About Facility Facts

Facility Facts is an informational newsletter issued quarterly by Facility Engineering Associates' staff to share innovative techniques, case studies, trends and general information on issues important to our clients.

Facility Engineering Associates is a national consulting engineering practice specializing in existing facilities and infrastructure. Our expertise is in the areas of:

- Condition Assessment • Facility Management • Repair and Restoration • Instrumentation • Environmental • Sustainability

These articles are for general information only, and may not fit your specific situation. If you would like to reprint an article or would like more information about a specific challenge you face, please contact:



Erin L. Parrent
11001 Lee Highway, Suite D, Fairfax, VA 22030
703-591-4855 newsletter@feapc.com www.feapc.com



Financial Perspectives for Green Investments, Part II

By Conrad T. Kelso, PE

In the last issue of *Facility Facts*, we looked at how to determine the Net Present Value (NPV) of a potential sustainability initiative and why the NPV method is considered superior to a basic payback period in terms of determining potential savings. The payback period is easy to calculate, but it neglects the actual value of the project by not considering all the future savings the project will generate after the initial costs are paid back. The NPV is the total present value of future cash flows, or more simply, today's dollar value of all future outlays of cash. NPV considers the "time value of money," the idea that money available at the present time is worth more than the same amount in the future, due to its potential earning capacity. This core principle of finance holds that, provided money can earn interest, any amount of money is worth more the sooner it is received. While performing a NPV calculation, the anticipated rate of return needs to be assumed; this rate is referred to as the "discount rate." This rate is typically the interest rate the organization would expect to receive if they put their money elsewhere (such as a bank). But the return from a sustainably project isn't usually given as an interest rate like the return on an investment in a bank account. How can we evaluate them on equal terms? The answer is to determine the project's Internal Rate of Return (IRR).

The Internal Rate of Return is defined as "the discount rate that generates a zero net present value for a series of future cash flows." The IRR is the rate of return on a project that makes the sum of the present value of future cash flows and the final market value of the project equal to its current market value. To put it another way, the Internal Rate of Return is the "hurdle rate", whereby any project should be avoided if the cost of capital (i.e. the interest rate you could otherwise earn in a bank account) exceeds the calculated IRR.

For an example of how to calculate IRR, let's say you are interested in installing a solar array on your building. The cost of the solar array is \$250,000. After the initial investment, the array begins generating \$20,000 a year in electricity over the next 25 years. The simple pay back period for this example is 12.5 years, way beyond what many organizations would be willing to wait for a payback period. But is the project potentially worth the investment over the long haul? Let's determine the Internal Rate of Return.

The Internal Rate of Return is expressed mathematically as:

$$CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \frac{CF_n}{(1+r)^n} = 0$$

Where CF = cash flow in a given period, n = number of time periods (years in our case) and r = Internal Rate of Return.

In our example, Year 0 is the year of the initial investment; since the initial array installation costs money up front, this value is going to be negative. From then on, however, the array will be producing electricity and a benefit will be positive

cash flow in the form of energy savings over the next 25 years. Using the values in our example the expression becomes:

$$-250,000 + \frac{20,000}{(1+r)^1} + \frac{20,000}{(1+r)^2} + \frac{20,000}{(1+r)^3} + \dots + \frac{20,000}{(1+r)^{25}} = 0$$

Solving the equation for r is an iterative process best performed with the aid of a financial calculator or spreadsheet. In this example r is found to be about 6.24% (Not bad considering current 30-year T-Bill rates.) Of course, this is a very simple example. Anyone serious about proposing a project to management would need very good estimates on project cost, project savings, and project life span in order to get an accurate estimate on internal rate of return. It is important to research similar projects and their associated costs and savings in order to present an intelligent, educated case on why the project should be undertaken.

The benefit of using IRR to help determine whether or not to undertake a sustainability initiative, or any other project, is the formula's flexibility to include diminishing returns, subsequent injections of capital, or even salvage value at the end of the life-cycle. Also, a rebate from a utility provider or tax incentive can easily be included in the formula. Any rebate or incentive should bring the initial project cost down or increase the cash flow in the subsequent years, increasing the IRR.

Unfortunately, if there are multiple projects being considered, IRR will not be useful when deciding which project to invest in, only if a single project is considered financially viable and worth the effort. IRR cannot be used to correctly prioritize based on financial return alone. Ranking projects based on IRR undervalues cash flows that occur late in a project's life. It therefore creates a bias for projects with early positive returns relative to projects whose returns tend to occur later. The significance of this bias is greater the longer the duration of project cash flows and the more severely constrained the capital budget.

Despite these shortcomings, IRR is good information to have when presenting a sustainability project to upper management. Decision makers may find it easier to compare investments of different sizes in terms of percentage rates of return rather than by dollars of NPV, even though NPV is still useful in the decision making process. When presenting a sustainability initiative, it is best to provide as much information as possible using the financial tools at your disposal. Determining NPV may be more time consuming but since it takes into account the time value of money, it helps determine if the project will increase the organization's asset value. And the payback-period is a quick, simple calculation that is easy to understand. By using all the tools at your disposal, projects that are good for the environment and good for the pocketbook can be easily recognized as good for the organization.

If you have any questions, feel free to contact Conrad Kelso at conrad.kelso@feapc.com.

Did You Know...



FEA performs *Statement of Energy Performance* (SEP) validations for buildings seeking the ENERGY STAR label. This is the final step to earning the ENERGY STAR building label.

After you have:

- set up your Portfolio Manager account,
- benchmarked your building,
- received a rating of 75 or higher, and
- generated your Statement of Energy Performance,

FEA's professional engineers can validate your SEP and get you on your way to receiving the ENERGY STAR label!

The ENERGY STAR label is an annual rating denoting superior building performance. Validation must be performed by a professional engineer (P.E.) who is knowledgeable in building systems, ASHRAE Standard 55, ASHRAE Standard 62.1, and the IESNA Lighting Handbook.

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Fairfax, VA 22030

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July 15-19 • St. Louis, MO

National Society of Professional Engineers Annual Conference

James Justus will be attending for FEA.

July 22 • New York City, NY

Real Estate Power Forum 2009

Teena Shouse will be presenting the key note entitled *Sustaining Sustainability*.

September 12 • Portland, ME

Maine Condo Forum and Expo

Rebecca Gutierrez will be exhibiting for FEA.

September 22-23 • Las Vegas, NV

Facility Decisions 2009

Teena Shouse will be presenting *Keep It Simple: The Five Things You Need to Know to Create Sustainable Sustainability*. And Laurie Gilmer will be presenting *What's Your Score? Benchmarking Energy Use through ENERGY STAR*.

September 27-30 • Iowa City, IA

Midwestern Region of the Association of Higher Education Facilities Officers (MAPPA)

Mark Sekula and Pete Domenico will be exhibiting.

September 29 – October 2 • San Francisco, CA

Society for Food Service Management National Conference

Teena Shouse will be presenting *Building Partnerships versus Executing Contracts*.

October 4-7 • Portland, ME

Eastern Region of the Association of Higher Educational Facilities Officers (ERAPPA)

Teena Shouse will be presenting *Tribal Knowledge and a Diverse Workplace: Bridging the Gap with Effective Mentoring*. Maureen Roskoski will be presenting *Imagine an Energy Efficient Campus: Benchmarking Energy Use through ENERGY STAR*. And James Whittaker will be teaching the *APPA EFP Exam Review Course* on October 3. Rebecca Gutierrez and Mary Kate Toomey will be exhibiting for FEA in Booth #63.

October 7-9 • Orlando, FL

International Facility Management Association World Workplace 2009

James Whittaker and Daniel Geldermann will be co-presenting *Building a useful Asset Management Plan – Tailoring facilities information to support enlightened facilities management decisions*. Christopher Hodges and Sean Delehanty, Principal Engineer of BAE Systems, will be co-presenting *Using a Room by Room Approach to Energy Curtailment and Greening at BAE Systems*. Laurie Gilmer and Bill Conley, Managing Director of Pacific Building Care, will be co-presenting *Sustaining Sustainability: How to Create Long Term Sustainable Operations in your Facility*. And Teena Shouse and Bud Jeffress, Vice President of Operations at the Kauffman Center for the Performing Arts, will be co-presenting *Begin with the End in Mind: Case study highlighting early involvement of FM Strategy in Construction*. FEA will also be exhibiting in Booth #612.

