



E Z S I M

BILLING ANALYSIS SOFTWARE

Savings Verification for Performance Contracting

EZ Sim is a convenient way to confirm energy savings under a performance-based contract and it can closely estimate actual savings even without the monitoring information that normally supports such a contract.

Washington's Department of General Administration supervised an energy system retrofit of Spokane's Westlake State Hospital and then was responsible for verifying the energy savings resulting from

the improvements. However, when the hospital's energy management system experienced a partial loss of data due to a computer glitch, EZ Sim provided the needed evidence that the contract was completed and matched contractual requirements.

The energy services company and the hospital were operating under a typical performance-based contract in which the ESCO had agreed to provide energy savings within 10 percent of an estimated

"With EZ Sim graphs and tables, the information was extremely easy to understand and the staff are fully convinced that the energy savings measures are working."

– Art Arenson

549,000 kilowatt-hours of savings. The parties had intended to use information from an energy

management system to verify the savings, but the data was lost due to computer malfunctions.

With the project complete, the parties still needed to agree that the savings were met before the DGA and hospital could sign off on the project.

Since the project was fairly simple, DGA did not want to go to elaborate expense in order to verify the savings. Yet the verification



Spokane's Westlake State Hospital Retrofit





needed to be sufficiently robust to demonstrate that the contractual guarantee had been accomplished. Using only billing and weather information, EZ Sim estimated a bill reduction that is within the allowed 10 percent range of the contract.

Just as important, EZ Sim presented the billing and savings information in an easy to understand format, not in an engineering report format that is difficult for lay people to understand and that is normally associated with performance contract verification. This helped all parties, including hospital staff, to understand that the energy management measures installed at the hospital were contributing to the hospital's bottom line.

"It was a challenge to get across to the operations staff at the hospital that the conservation measures were really working," says Art Arenson of the DGA. "But

with EZ Sim graphs and tables, the information was extremely easy to understand and the staff are fully convinced that the energy savings measures are working."

EZ Sim presented the billing and savings information in an easy to understand format.

This analysis posed a challenge to EZ Sim because the second year of the study included an abnormally hot summer. Consequently, the energy consumption from the first to second year differed considerably. But EZ Sim dealt with this event by estimating what the old building would have used under the same hot conditions. Including the weather effect, EZ Sim estimated a bill reduction of 524,000 kWh, compared to the 549,000 estimated by the contractor. With a 10% shortfall allowed by the contract,

the target was only 494,000 kWh, and so actual savings were better than the contract minimum.

Using EZ Sim to review the pre-and post-retrofit utility bills provided a clear picture that the savings goal had been met. DGA staff presented EZ Sim's charts as clear, graphical quantification of the actual savings. All parties were able to agree that the project was successfully completed.

Mission accomplished!

"EZ Sim was very beneficial in providing buy-off by all the parties," says Arenson. "It brought complicated results down to a level that everyone could understand. EZ Sim is definitely the way to do it."

Arenson was pleased with the way EZ Sim handled what was actually a complex situation, but in a way that was inherently simple, low-cost and easy to understand. "This was a great application for EZ Sim," says Arenson.

Verification for a Performance Contract

The Westlake State Hospital is a moderate-sized building of 107,328 square feet that is heated with natural gas.

The pre-retrofit billing data reveal an orderly pattern for both the electric and gas usage, as shown in Figure 1. In this graph, the y-axis shows the average energy usage in watts per square foot and the x-axis shows the mean

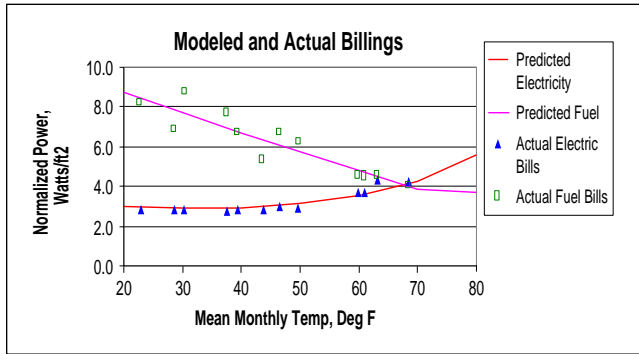


Figure 1. Pre-Retrofit Consumption

monthly temperature. This type of graph is an operating profile that demonstrates how the facility behaves under certain weather conditions.

Figure 2 shows a similar comparison on a monthly basis.

This type of graph is

referred to as a commissioning plot. It shows the actual and predicted electricity consumption as bars on a graph. Consumption estimated for the baseline or pre-retrofit facility under the same conditions is shown as a black line above the bars. By comparing the bars to the baseline, it is apparent that the facility is performing close to expectations.

Savings in a typical weather year are 682,677 kWh, including benefits from reduced air conditioning loads. This works out to a 22% saving of the annual electricity consumption.

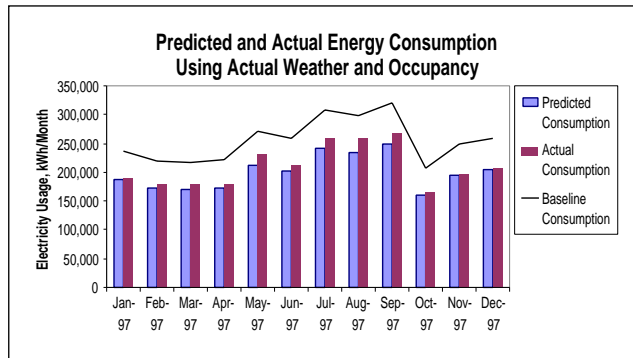


Figure 2. Post-Retrofit Commissioning Plot

EZ Sim is also able to compute the precision of the savings estimate based on the match to the billing data. In this case, the typical savings of 22% have a standard error of 2% relative to annual consumption. Any uncertainty is small relative to the amount of the savings. Or, as shown in Figure 3, the observed bill reduction of 524,000 kWh has a 90% confidence limit of + 141,341 kWh/year.

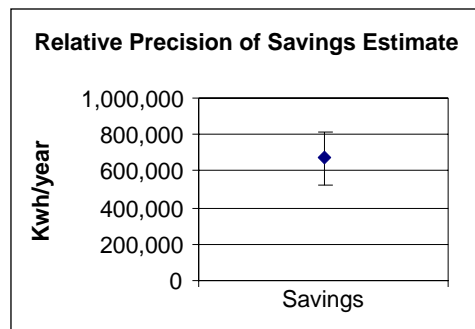


Figure 3. Savings Estimate and 90% Confidence Band

Modeling Parameters

Model Set-up

- Set lighting connected load at 1.81 W/sq.ft. pre-retrofit based on audit.
- Enter 0.7 W/sq.ft. for the hot water heating fuel. This is a high value reflecting hospital usage.
- Set Heating Setpoint to be the same for both Unoccupied and Occupied periods. There is no night setback for this or nearly any other hospital facility.
- Set up HVAC system with On/Off controls (simple thermostat), gas space heating and packaged unit air conditioning.

Model Tuning

- Adjust plug loads based on calibration.
- Adjust Fuel Process load based on calibration.
- Adjust Heating Use Modifier to 0.8 based on calibration.
- Adjust Peak Factor for lighting and plug loads based on calibration of the Demand Profile. Use a 50% peak factor to reflect the fact that light usage is low at the time peak occurs, which is during the early morning warm up.

Conservation Measures

- Efficient lighting: use proposed connected load of 0.75 W/sq.ft. from lighting audit.
- Increase fan/motor efficiency to .7 for improvements to fans.

Energy Analysis at your fingertips

EZ Sim billing analysis software

EZ Sim is the next step in energy accounting. Using actual utility bills, it reveals the patterns of use in commercial buildings.

EZ Sim:

- Diagnoses energy patterns and consumption
- Calibrates savings estimates to agree with actual energy usage
- Estimates energy end-uses within the facility
- Verifies vendor claims for energy products and services
- Generates performance targets and compares against actual energy bills

EZ Sim is a quick spreadsheet tool that is equivalent to a sophisticated engineering analysis, but **you**

don't have to be an engineer to use it. It's designed for resource conservation managers and facility operators.

EZ Sim uses actual energy bills and available information, so **the cost to operate EZ Sim is almost nothing.**

EZ Sim lets you use utility bills to calibrate a simulation of a commercial building in an interactive graphic window. **Once it matches the building's utility bills, the simulation model provides reliable and realistic estimates of potential conservation savings.**

With **EZ Sim**, the calibration process reveals how energy is used within the facility to **help diagnose the reasons for excessive consumption or poorly functioning components.**

Best of all, **EZ Sim** can be used to predict what future utility bills should be and can help you set performance targets to determine if installations are on track. **This is the simplest form of building commissioning — and at very little cost.**

STELLAR PROCESSES, INC.

Stellar Processes is a company of consulting engineers specializing in energy economics, measurement and verification. Experts in monitoring and commissioning large facilities as well as diagnostic evaluation of small buildings.

Support provided by:



June 2000

1033 SW Yamhill, Suite 405
Portland, OR 97205
(503) 827-8336
www.ezsim.com