Energy Assets[sm] program and the Minnesota design community: trends in co-evolution

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1. SYNOPSIS

Since 1993, the Energy Assets design assistance program has collaborated with the building design community in Minnesota and improved the construction industry's energy efficiency baseline.

2. INTRODUCTION

To create a stronger economy and a cleaner environment for Minnesota, a utility-sponsored energy design assistance program was introduced to the community (after piloting at the University of Minnesota). The program provides information to owners and designers, early in the design process, and it combines computer simulation of designs with an implementation-verification process. For each project, the process evaluates approximately seventy alternative strategies to affect all energy-end-uses and fuels, without compromising the original design aesthetics. The utility funds the consultant-based analysis and verification processes, compensates the architectural and engineering team for their participation and provides incentive money for implementing cost-effective strategies. Savings are based on DOE2 models compared to operation at a level compliant with the ASHRAE 90.1 1989.

While continuing to evolve with the changing needs of the construction industry, the design assistance service has been able to influence the design and owner communities to raise their baseline designs to include strategies like daylighting and load-responsive operation. The Energy Assets process is now standard practice for many firms in the area, and the number of buildings that are included in the program has been increasing steadily every year. Here, we look at the co-evolution of Energy Assets and the design community, noting trends in initial design savings, final savings, incremental costs of selected strategy bundles, as well as feedback from the verification stage, across the first seven years and 128 projects.

3. SUMMARY STATISTICS

- From 1993-2000, the design assistance service has addressed 31.3 million SF of new commercial construction.
- Peak electric savings average 26%, totaling 46.1 MW compared to the ASHRAE 90.1 1989 base.
- Average CO_2 reduction is 31%, or 157,000 tons per year.
- Annual savings add up to $12.5 million in building operating costs to the local economy.

Table 1. Summary results by building type

Building Type	Number of Projects	Total Area in SF	Average Peak W/SF ASHRAE 90.1 1989 Base	Peak KW Saved	% Peak KW Saved	Annual Energy Savings	% Annual Energy Savings
Education	40	6,008,760	5.8	9,673	28%	$2,712,863	36%
Office: owner-occupied*	31	12,481,200	9.5	19,308	26%	$5,276,057	25%
Office: tenant occupied	18	6,074,657	4.4	6,508	23%	$1,571,984	23%
Health	7	1,407,673	7.9	3,058	28%	$698,637	32%
Retail	7	877,184	6.9	1,901	31%	$408,987	30%
Housing	5	1,028,544	5.2	1,252	23%	$228,620	20%
Detention	4	1,031,516	3.9	1,061	27%	$422,102	33%
Manufacturing	3	374,865	6.8	605	25%	$117,249	23%
Recreation	2	208,316	5.7	370	32%	$65,411	28%
Transportation	2	697,767	4.2	811	27%	$317,351	30%
Other	9	1,128,964	4.7	1,578	30%	$654,945	31%

* includes office buildings where portions are labs, warehouses, manufacturing and retail

4. PROGRAM EVOLUTION

Through the 1990's, the time allowed for building design diminished by 10-30% as clients demanded quicker service, and concepts like 'fast track', 'design-build' and 'flash track' were introduced. The energy design assistance process evolved to match these needs. Since 1993, the time required for design assistance has reduced from roughly six months to six weeks. Changes to the process include:

- Development of standard energy savings strategies list, customised later during each project.
- Streamlining of consultation meetings, reduced from four to three.
- Development of a custom input and extraction system for DOE2.
- Development of *Energy Designer*, a self-guided software for small office buildings (allows designers to evaluate strategies in 20 minutes and apply for utility incentives, without the formal design assistance process.)
- Standardised verification procedures for the strategies.
- Verification of implemented strategies provides feedback that is used to improve modelling assumptions and strategy descriptions.

5. EVOLUTION OF THE DESIGN COMMUNITY

Design teams bring a proposed design (cost base) to the design assistance program. A few conservation strategies are already included in the cost base, but without the program, some of these strategies would be 'value engineered' out, and not implemented in the actual construction. Thus, cost base savings predicted in this study are a best-case scenario of the initial designs. The program provides a forum for evaluation of each strategy, based on explicit energy performance numbers. Over the years, the program has seen the cost base improve, compared to the energy code. We believe that design teams have learned to incorporate cost-effective conservation strategies as a matter of course through successive interaction with the program, albeit with the expectation of financial incentives for their clients. Here are some additional observations:

- Over the history of the program, there is a slight improvement (4%) in the trend for cost base savings (see Figure 1). The trend in savings might have been more significant, but for the fact that speculative buildings for office tenant occupancy (a building type generally not aggressive in terms of capital investment), have taken an increasingly larger portion of the program square footage, and as new design firms have continued to participate in the program the overall learning curve has not been very steep.

- Design firms that have participated more often in the program have shown a more significant improvement in their cost base designs (See Figure 2). This tends to be the larger, more competitive firms.
- Although the cost base savings (linear fit) show an increase over time, the energy strategy bundle savings do not; this suggests that new and more aggressive strategies need to be introduced for continued high savings.
- Payback periods for the selected bundles do not show change over time. The average payback period (not including utility incentive funding) for bundles of strategies selected for implementation is 1.04 years.
- Field verification reveals that the implemented strategy bundles have been consistently realising about 95% of the predicted savings.

Figure 1. Compare selected strategy bundle to cost base

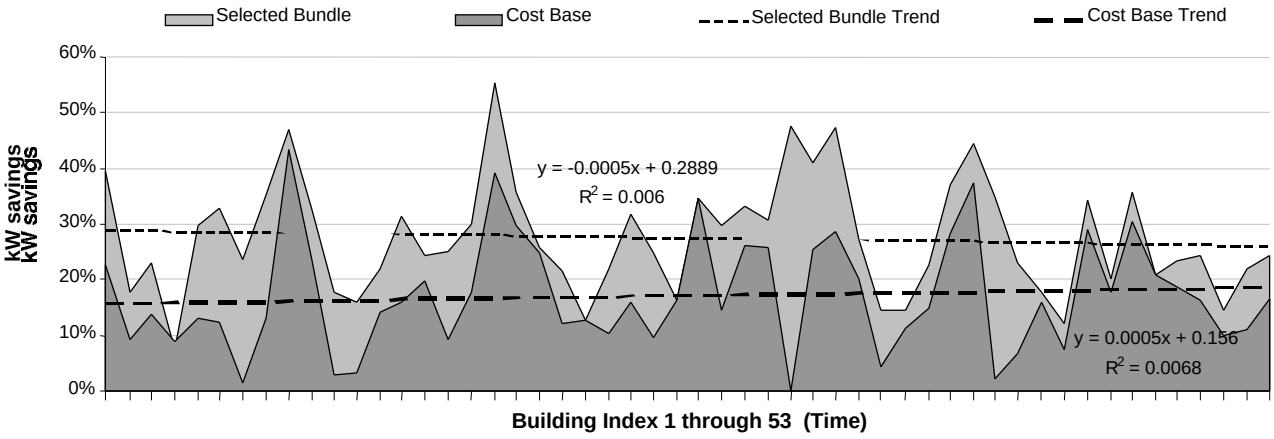
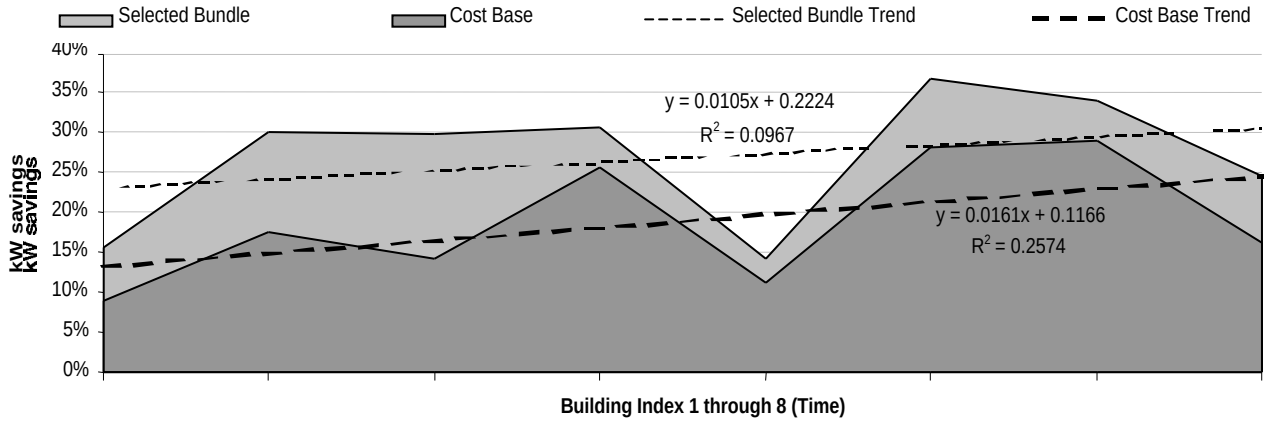


Figure 2. Compare selected bundle to cost base – trend for one design firm



6. BIBLIOGRAPHY

Herzog & Wheeler, Energy Assets Verification and Validation Reports for NSP (now Xcel Energy,) 1994-2000.

La Vine, Lance & Grimsrud, David, A Report to Electric Marketing of Northern States Power Company, 1999.

The Weidt Group, Energy Assets Design Assistance Reports for NSP (now Xcel Energy,) 1993-2000.