Commercial New Construction Programs: Results from the 90's, Directions for the Next Decade

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ABSTRACT

Many utility companies and others have offered commercial new construction programs during the past decade. These programs typically seek to promote energy savings beyond building energy code requirements or current baseline practices by incorporating a mixture of technical assistance and prescriptive and performance-based incentives. These programs have saved substantial amounts of energy and have helped advance standard construction practices.

Most commercial new construction programs were designed as resource acquisition programs. In many states, resource acquisition is no longer the prevailing paradigm and market transformation has become the dominant model. Under this new paradigm the emphasis is on removing market barriers and achieving long-term, sustainable impacts in the market so that more efficient practices become standard practice over time. Commercial new construction programs have historically contributed toward transformation of the marketplace. However, if current program designs were reviewed through the lens of market transformation and appropriate modifications made, commercial new construction programs could have even more impact on the market.

This paper reviews the history, structure and accomplishments of commercial new construction programs over the past decade, including some of the sustained market effects that have been achieved by these programs. We then analyze the technical opportunities for advancing commercial construction practices over the next decade, the barriers inhibiting the capture of these opportunities, strategies for overcoming these barriers, and options for sustaining these market effects in the long-term . Based on this information, modifications to current program strategies are proposed, which, if implemented, should result in even more market impacts over the coming decade than have been achieved in the past decade.

Introduction

More than 3.3 billion square feet of new commercial buildings alone were constructed from 1988 to 1998 (Census Bureau 1998). A 170% increase in commercial building stock is anticipated by the year 2030 (EIA 1997). That stock is expected to have a lifetime of between 50 to 100 years. This paper will review experience with commercial building new construction programs over the past decade and discuss ways to apply market transformation approaches to make these programs even more effective in the future.

History of Commercial New Construction Programs

The Southern California Edison Company first introduced commercial new construction programs in 1983 (Ander 2000). Programs spread throughout California, into

Wisconsin, the Northwest, and New England in the 1980s. These programs were the first attempt by utilities to directly influence the practice of design and construction of new commercial buildings.

At the time, Demand Side Management (DSM) programs were based on resource acquisition models. These models were based on the premise that utility-funded DSM programs would reduce electrical demand and, if the value of the energy savings (valued at the marginal cost of production) exceeded the program's cost, then the program was cost effective.

By the early1990s, commercial new construction programs began to proliferate. Many utilities and intervening organizations began to focus on "lost opportunity resources." These are energy saving opportunities that were available at a particular narrow point in time (e.g. at the time of new building construction), but if this opportunity is missed, the potential for capturing these savings are lost for many years. At that time, programs were introduced in Georgia, Maryland, Florida, Ohio, New York, and Canada, complementing the programs that began in the late 1980s in California, the Northwest, and New England.

By the mid 1990s, electric industry restructuring was beginning to sweep the states and programs that had small returns were dropped or eliminated in favor of larger programs. Examples include Southern California Edison's elimination of rebates in their commercial new construction program (Johnson 1995), the end of programs in the Pacific Northwest, and Consolidated Edison's elimination of their commercial new construction program. The surviving programs were well designed, had utility and regulatory allies, and a solid track record of delivering energy savings in new buildings.

Structure of New Construction Programs

New construction program designs vary considerably, but fall into two basic categories: (1) approaches that directly promote the use of certain energy-efficient technologies (component based), and (2) approaches that promote a minimum performance level for the overall building (performance based). These structures emphasize the fundamental intervention strategies adopted by program designers. (These approaches are discussed in more detail below.) While some programs emphasize one approach or the other, others combine the two approaches.

Component-Based Programs

Component-based rebate programs focus on providing an incentive for the installation of a particular technology. Rather than determining savings on a project-by-project basis, program designers precalculate the savings for individual energy conservation measures. The precalculated savings are assigned a value by the utility and rebate levels are established. The customer is paid based on how many units of a particular technology are installed (or in some cases, by meeting minimum performance-metrics such as lighting watts/sq.ft. or EER).

Component-based programs first emerged as crossover programs from traditional commercial DSM retrofit programs. The first program designed specifically for new buildings was done at Pacific Gas and Electric Company. The key features of these programs include:

- Simple and easy to explain program so that a designer or building owner can immediately assign a dollar value to their participation.
- Technical work is shifted into the program design phase freeing up field representative time to be with more customers.
- Stocking distributors and contractors that work with incentivized technologies can help market the program and increase market penetration.

Disadvantages of this approach are:

- The component-based programs do not promote integrated design.
- The program must be updated regularly to account for new technologies and changing product costs.
- Financial incentives are required to make the program successful.

Performance-Based Programs

Performance-based programs are specifically targeted at promoting integrated design in new commercial buildings. Integrated design is an approach that involves the coordinated design of two or more building systems. These programs have three distinct characteristics:

1. The thrust of the marketing effort is to identify projects early in the design cycle.
2. Incentives are provided to fund design analysis as well as capitalizing efficiency measures.
3. Savings are determined on a project-by-project basis using sophisticated whole-building simulation tools.

Performance-based programs were first pioneered by Portland Energy Conservation, Inc. working with utilities in the Northwest and with municipal California utilities. Northeast Utilities, New England Power Service Company, Central Vermont Public Service, and Southern California Edison also offered programs with a strong design assistance component.

Key features of these programs included:

- Customized assistance to overcome barriers within the building design process.
- Design integration enables lighting, envelope measures and HVAC equipment to be selected and optimized, maximizing energy and cost savings.
- Measure selection using a process to identify the most cost-effective set of measures for that particular building and operating conditions.
- Performance-based programs have been successful even when customers are not provided with direct financial incentives to participate. For example, PacifiCorp’s Energy FinAnswer program achieved high participation rates by providing a wide range of services, including extensive technical assistance and financing (Nadel, Pye & Jordan 1994).

Disadvantages to this approach include:

- It is difficult to sell the client on the benefits when the actual rebate amount cannot be determined until the end of the process.
- Design intervention is labor and time intensive because it requires the utility and its contractors to be an integral part of the design team.
- It's difficult to transfer the design choices on an individual project to a population of buildings, or to future tenants if it's a high-turnover building occupancy type (restaurant, retail, etc.).

Accomplishments

This section discusses some of the results of various commercial new construction programs in the 1990s. This includes programs in California, the Pacific Northwest and New England. These results are based on evaluations of the programs conducted using a variety of techniques.

Program Participation

Well designed and marketed commercial new construction programs have achieved participation rates of 30-70% of new floor space (these participation figures are dominated by large buildings and the participation rates for small buildings are inevitably lower). Examples of programs that have achieved participation rates of 30% or more include BC Hydro's Commercial New Construction Program, Massachusetts Electric's Design 2000 program, PacifiCorp's Large Commercial Energy FinAnswer; PG&E's Commercial New Construction Program, and United Illuminating's Energy Blueprint program (Nadel, Pye & Jordan 1994).

Spillover

In addition to direct savings in participating buildings, there are several documented cases in which commercial new construction programs influenced broader changes in the commercial new construction market. For example, PG&E's rebate programs that were operating in the late 1980s and early 1990s provided an incentive for designers to lower lighting power densities in two ways; (1) the use of automatic lighting controls, and (2) the use of more efficient technologies, such as electronic ballasts. When the program began, fixtures could not be ordered with electronic ballasts. By 1999, an evaluation of the California commercial new construction market found that more than 80% of fixtures in new buildings used electronic ballasts, even though participation rates in the PG&E program were less than 50% (Wright 1999).

Energy Savings

Commercial new construction programs achieved significant energy savings in new buildings built to take advantage of the various programs. Programs delivered savings between 6% (Wright 1997) to 20% (Diamond et al. 1992) with individual building savings exceeding the baseline by more than 50% in some cases (Wright 1999). The savings estimates for electricity were more reliable than the savings estimates for gas (Analysis Group 1993).

Program Cost-Effectiveness

Commercial new construction programs tend to be in the middle of the cost-spectrum for energy efficiency programs. A 1994 study (Nadel, Pye & Jordan) of five major programs found that costs per kWh saved ranged from 1.6-3.5 cents per kWh, making these programs cost-effective relative to most estimates of the marginal cost of new electricity supplies.

Avoided distribution system expenses in high-growth areas also contribute to the cost-effectiveness of these programs.

Relationship to Code and Standard Enhancements

Commercial new construction programs have used building energy codes and standards as baselines since their inception. Once programs are designed and operated, program evaluators often find that commercial buildings are built more efficient than minimum codes as a matter of practice (Warfel 2000). In some cases, efficiency advocates have used this evidence to promote adoption of upgraded energy codes, thereby locking in savings achieved through new construction program efforts.

For example, in 1998, the California Energy Commission (CEC) proposed new lighting power densities. The lighting power densities being proposed were higher than observed values in a study of new buildings conducted by PG&E (and summarized in Table 1). PG&E met with the CEC and used their study to provide evidence that the typical building in California could be designed to a lower lighting power density. In addition, PG&E provided examples of buildings that had achieved even lower lighting power densities through their incentive program. As a result of this evidence, the CEC strengthened its standard proposal. In July 1999, new standards took effect that reduced lighting power densities in select building types. Table 1 identifies the key changes that occurred as a result of PG&E's efforts.

Table 1. Select Lighting Changes - 1992 to 1999[1]

Space Type	1992 CEC Standards (Watts/ft^2)	1999 Baseline Study Results (Avg. Watts/ft^2)	1999 CEC Standards (Watts/ft^2)
Bank/Financial Institution	1.8	Included in Office	1.4
Classrooms, Lecture, Training, Vocational Room	2.0	1.37	1.6
Grocery Store	2.0	Included in Retail	1.6
Kitchen, Food Preparation	2.2	Included in Restaurant	1.7
Medical and Clinical Care	1.8	Included in Office	1.4
Office	1.6	1.22	1.3
Retail Sales, Wholesale Showrooms	2.2	1.64	2.0

However, while the PG&E program did ultimately influence the California code, it required special analysis and effort after the utility program had been in operation for many years. In the following section, we propose approaches for making the connection between codes and utility new construction programs more direct and up-front, which will hopefully allow new construction programs to have even more impact on codes in the future.

[1] The values in this table are taken from the "area category method" in the California Nonresidential Standards.

New Directions for Commercial New Construction Programs

Opportunities

As discussed above, new commercial buildings are now substantially more efficient than buildings built a decade ago. However, there are substantial additional opportunities to improve efficiency. As the baseline for this discussion, we use the new ASHRAE 90.1-1999 standard. We expect many states to adopt the ASHRAE standard into their building codes in the next few years (in fact, the Massachusetts Energy Code is already equivalent to 90.1-1999), and thus this standard is likely to provide a baseline for efforts to promote further efficiency improvements.

Opportunities to improve building efficiency fall in six major areas:

1. Building envelope
2. Lighting systems
3. Building mechanical systems
4. Power systems
5. System integration
6. Functional performance verification

The building envelope requirements in 90.1-1999 are based on an economic criterion that is equivalent to lifecycle costing with a 12% real discount rate, and capping measure lives at 30 years. In fact, many envelope components have lives or 50 years or more, and economic analyses for building codes are commonly based on real discount rates of 8% or less. If we substitute a 4% real discount rate into the ASHRAE screening methodology, and keep all other assumptions (even measure life) the same, building envelope requirements increase significantly. For example, if these economic criteria were applied to Boston, MA, it would change several envelope requirements as shown in Table 2 (NBI 2000).

Table 2. Comparison of Envelope Criteria Based on ASHRAE Criteria and Lower Real Discount Rate

	Description	90.1-99 R-value	Revised R-value
Walls	Mass – Cavity plus Continuous (ci)	R 7.6 ci	R-9.5 ci
		90.1-99 U-value	**Revised U-value**
Windows	Fixed	0.57	0.45
	Operable	0.67	0.47
		90.1-99 SHGC	**Revised SHGC**
Windows	North	0.49	0.46
	Non-North	0.39	0.36

Overall, if all envelope requirements in 90.1-1999 are revised using these new criteria, whole building energy use can be reduced by an average of about 8% (Johnson 1998). Additional savings can be achieved through use of overhangs, high-albedo roofs and other techniques for reducing heat gain from sunlight.

The lighting power density requirements in 90.1-1999 are based on generous lighting allocations and allow use of many specialized decorative and glare-reducing fixtures. In California, Washington, Oregon and Minnesota, common design practice typically exceeds the ASHRAE lighting levels by a significant amount. This is illustrated in Table 3, which compares 90.1-1999 requirements with typical buildings built in California between 1994 and 1998. On average the Title 24 requirements exceed ASHRAE's by approximately 13% (NBI 2000) while the hundreds of buildings in the PG&E program save about 26% additional (Wright 1999). In addition, large, cost-effective energy savings are possible in appropriate applications from use of daylighting and various lighting controls including occupancy controls and dimming controls.

Table 3. Comparison of ASHRAE, California Code and Actual Lighting Power Densities in Average and Efficient New California Buildings

	Lighting Power Density (Watts/ft^2)			
Building type	**ASHRAE 90.1-1999**[2]	**California Title 24 (1999)**	**Avg. Building in California 1999 Baseline Study**	**California 1999 Utility Program Qualification Levels**
Office	1.3	1.2	1.22	1.08
Retail	1.9	1.7	1.64	1.53
Schools	1.5	1.4	1.37	1.26
Public Assembly	1.5	1.8	1.27	1.62

Sources: ASHRAE 1999, Wright 1999

Building mechanical systems also provide substantial opportunities for energy savings including increased equipment efficiencies as well as improved system design. For example, for a 10-ton (120,000 Btu/hour) rooftop cooling system, 90.1-1999 requires an EER of 10.3 after October 29, 2001 while many utility programs are now emphasizing EER 11 and above (CEE 1999). For a 300-ton water-cooled centrifugal chiller system, ASHRAE will require an efficiency of 0.64 kW/ton (5.5 COP) while systems with efficiencies as low as 0.53 kW/ton are readily available and cost-effective from several manufacturers (Suozzo et al. 1997). And a 1996 analysis for DOE found that the minimum lifecycle cost point for a commercial boiler under average operating conditions was 79% thermal efficiency, significantly higher than the ASHRAE value of 75% (PNNL 1996). Furthermore, savings from smart system design are generally greater than savings from improved equipment efficiency. For example, a 1993 analysis found that with clever system design, a large chiller system with an efficiency of 0.50 kW/ton under design conditions could actually operate with an average efficiency of 0.35 or less (Nugent 1993). Likewise, the energy use of packaged systems can be reduced through careful attention to duct design, duct sealing, proper installation, and careful control so that cooled or heated air is only provided when and where it is needed (Wolpert & Houghton 1998).

Power systems include transformers, wires, and metering equipment. Many of the leading transformer manufacturers have recently come out with product lines that reduce transformer losses by approximately 30% with typical simple paybacks of 1-5 years (Hinge et al. 2000). There are also savings opportunities from installing meters at key places in the building in order to monitor energy use and system performance and catch problems as they develop.

[2] Both the ASHRAE and Title 24 lighting power density values were derived from the "building area and complete building" method tables.

Some of the largest opportunities for energy and cost savings are from integrating different building components into an integrated system. For example, low power lighting systems and advanced glazing products can substantially reduce building heat gains, allowing cooling systems to be downsized, or in some cases, simpler, lower-cost systems to be installed. Table 4 shows the effect of reducing the cooling load through daylighting and electric lighting power reductions.

Table 4. Integrated Design Example

8' x 12' South Facing Office	Cooling Load (Tons per Office)	Air Flow (CFM per Office)	Peak Demand (kW per Office)	Operating Costs ($/sf/yr)
Base Design - (Code)	0.367	141	0.70	$1.09
Option 1 - Daylighting w/ reduced lighting power density	0.233	78	0.47	$0.74
Option 2 - Option 1 w/ automatic daylighting controls	0.192	59	0.40	$0.64

Source: Ternoey 2000

Finally, even the most efficient and advanced measures are frequently not installed properly. Commissioning new buildings can lead to significant and cost-effective energy savings. For example, Bjornskov et al. (1994) found that commissioning typically provides operating cost savings of 7-15% with simple payback periods of 1.8-3.0 years. In addition, there are substantial opportunities to install diagnostic sensors and meters during construction, allowing building operations staff to more easily spot and correct building operations problems. For example, researchers using automated diagnostics found that 6 out of 7 air handlers on a newly built and commissioned building were not operating correctly (Brambley 1999).

Taken together these different measures can typically reduce commercial building energy use by 30%, or more relative to ASHRAE 90.1-1999, often at little or no incremental cost. For example, in 1996, the State of Utah piloted a program to improve the energy efficiency of new State buildings (Case 1998). Seven buildings beat the ASHRAE 90.1-1989 code by at least 20% (and thereby exceeds 90.1-1999 since preliminary analysis shows the 1999 ASHRAE standard results in energy savings up to 17% relative to the 1989 standard) (Jarnagin et al. 2000) with four exceeding it by 50% and one by 40%. This was achieved with a zero increase in first cost.

Barriers

While the opportunities to improve the efficiency of new commercial buildings are substantial, so are the barriers that inhibit adoption of these measures. The major barriers facing both past and future commercial new construction programs are:

- Most building owners are unfamiliar with many of the energy-saving measures available today and the benefits of these measures including energy-savings and improved occupant comfort. Even when they are familiar with many of these measures, they may be skeptical that the benefits are as large as purported.
- Building owners tend to focus on reducing first cost and are reluctant to spend extra for energy-saving measures. When extra money is spent, it tends to be spent on visible

elements, such as improved finishes in the lobby and not hard-to-see, energy-saving measures.

- Many building designers and contractors are also unfamiliar with many advanced energy saving measures, and even when they know about specific measures, often lack the detailed knowledge needed to sell these measures and install them cost-effectively (e.g., they may sell measures at premium prices, in order to allow extra time for their learning process).
- There is often inadequate time for building owners and their design teams to consider new design approaches or to change building specifications. Many projects today are built on a "fast track" and ideas that may cause delays, or are even perceived to possibly cause delays, receive short shrift.
- There is risk involved in using new measures. Not all energy-saving buildings and measures perform well, and previous bad experiences can make owners, designers and contractors all reluctant to try anything that is not "tried and true."
- The fee structure for architects and engineers is typically based on a percentage of building cost. This structure provides little incentive to spend extra time on building integration and other complex design strategies that increase design time but reduce operating costs, and sometimes even reduce construction costs.
- Many building owners care little about building operating costs because these costs are passed onto tenants. Tenants also generally do not care much about operating costs because they tend to be hidden in the rent and because tenants are unfamiliar with the magnitude of operating cost reductions that are possible.

Strategies

In order to overcome these barriers, a number of strategies have traditionally been used, such as building codes, education and technical assistance for owners and their design teams, and financial incentives. As discussed earlier in this paper, these strategies have saved a substantial amount of energy, but in light of recent thinking and experience with market transformation strategies, current strategies can probably be refined and improved upon to increase program impacts. In this section, our recommendations for these refined strategies for the next decade are illustrated.

In our opinion, commercial new construction programs should focus on two complementary strategies, which we label *code plus* and *enhanced value*. These two strategies complement building codes in many jurisdictions that set a minimum efficiency floor. In the past, building codes have proven to be a very effective way for permanently transforming commercial new construction markets. The challenge with a building code is that too often it defines an energy efficient building. The code plus strategy creates a new definition of an energy efficient building by delivering cost-effective savings to the building owner. The enhanced value strategy then enhances the market appeal of high-performance buildings by building on the code plus with specific technologies and practices that enhance the built environment.

Code plus. The primary objective of a code plus strategy would be steady adoption of code improvements into state (and sometimes municipal) building codes. By focusing on code improvements, program operators can feasibly have even more impact on codes in the future than they have had in the past. However, while changing codes would be a major internal focus, this objective would not be publicized externally since some potential program allies may not be supportive of the code change agenda.

As the foundation for a code plus strategy, we recommend that program planners work with code officials and building designers to develop a voluntary new construction standard that is in the same general format as current codes, including the use of code compliance tools, but incorporate more stringent requirements. This voluntary standard would serve two purposes; (1) it would provide a specific package of measures that could be marketed to building designers and developers, and (2) it would provide the basis for future code change proposals. The requirements in the voluntary standard would need to be:

- cost-effective to building owners;
- include only those measures that lent themselves to a prescriptive standard (e.g., lower watts per square foot for lighting but not requirements for integrated systems design); and
- include only those requirements that were sufficiently advanced in terms of market understanding and practice that they could reasonably be included in building codes within a few years.

The requirements should be written into the code format, because that is the format designers are most familiar with and required to use whether they participate in the program or not. Utilities and other program operators would then provide technical assistance and financial incentives for meeting this voluntary standard, thereby building familiarity and experience with this standard and laying the groundwork for adoption of all or parts of the standard as a new building code. Upon adoption of a new code, a new voluntary standard could then be developed that is even more stringent than the new code and includes measures that were too new for inclusion in the old voluntary standard, but that now were appropriate given market developments over the preceding several years. Even in states without codes, the voluntary guideline would still be useful since it provides a focus for marketing efforts, and a concrete package of measures that can easily be adopted and implemented.

An example of this approach is Ontario Hydro's new construction program (1991-1993). In 1991, Ontario Hydro conducted research on the commercial new construction market in Ontario and concluded that the best course of action was to encourage the provincial government to adopt the ASHRAE 90.1-1989 building standard as a mandatory code. In 1992 and 1993, Ontario Hydro offered training on the ASHRAE standard and paid incentives for buildings meeting this standard; 29% of new commercial floor area built during this period participated in the program. In 1993 the provincial government adopted the ASHRAE standard and Ontario Hydro agreed to continue to fund training programs for building officials and building designers on the new code. In addition, the utility offered incentives to building designers for new buildings that exceeded the new code, thereby helping to lay the groundwork for future code updates (Lemoine 1994).

Enhanced value. An enhanced value strategy would seek to overcome barriers to efficient construction practices by increasing the perceived value that decision-makers place on efficient construction practices. For most building owners, reducing operating costs is not a major motivation. An enhanced value strategy would focus on demonstrating and promoting construction strategies that provide multiple benefits in addition to energy savings. These benefits include improved occupant comfort (both in a thermal and aesthetic sense), reduced construction costs, improved equipment durability and ease of operations, improved worker productivity, and reduced impacts on the environment. Specific benefits to an enhanced value building could be promoted to owners through marketing programs, case studies, and financial incentives. In addition, these benefits could be promoted to tenants in a more general way, because if tenants begin to ask about specific benefits to an enhanced value building, owners are much more likely to respond (the Northwest Energy Efficiency Alliance is now beginning such a program, Harris 2000).

In addition, these measures should be promoted to design professionals through education, technical assistance, and experimentation with new fee structures. The latter will provide enhanced value to design professionals, and help to make them advocates for these advanced design strategies (Eley, 1998, discusses a pilot program along these lines). The enhanced value strategy would build off the code plus strategy in that a "valuable" building would be an energy efficient building (as defined by codes plus) and include some specific features that went beyond code plus to enhance the built environment. Among the measures that could be emphasized in an enhanced value strategy would be daylighting (several recent studies have positively linked daylighting to improved school test scores and retail sales, Heshong 1999); occupant-specific control over lighting and HVAC; integrated building design; and building commissioning. Many of these measures are difficult to require through building codes, and thus an enhanced value strategy can be a nice complement to a code plus strategy. However, changing attitudes and values is a slow process, so an enhanced value strategy should be viewed as a long-term effort and not a quick route to success.

Synergies. Code plus and enhanced value strategies are complementary in several ways. First, as noted above, code plus strategies are only appropriate for measures that are potential candidates for codification. Enhanced value can promote additional measures that are very difficult to incorporate into codes (or that we may never want to). These two strategies also lend themselves to different market segments. Code plus will tend to appeal to customers who want a cookbook approach and do not want to spend a lot of time with design (pragmatists and late adopters[3]). These are the customers who tend to participate in the prescriptive portions of today's programs. Enhanced value will primarily appeal to the high-end of the market, including owner-occupied spaces and class A leased space (innovators and early adopters). These are the same market niches that the comprehensive design components of today's programs target. Finally, the code is there to address a part of the market that will only be affected when poor performing technologies are removed from the new construction marketplace (laggards).

In addition to targeting the technology leaders, the enhanced value portion of the program can be a proving ground for new measures, laying the groundwork for these measures to be incorporated into future code plus packages.

Overall, we can envision a marketing strategy that discusses "good," "better" and "best" practices to commercial new construction, where "good" is code plus, "better" includes some enhanced value components, and "best" is a comprehensive and optimized design incorporating many enhanced value components as well as easily meeting the code plus standard. However, even in marketing the code plus component of the program, the

[3] These terms are used by Harry Beckwith (Beckwith 2000) when describing a technology adoption curve.

marketing message should emphasize value, since it is value that will motivate owners and designers to adopt any of the measure packages.

Examples. Several past programs illustrate how both code plus and enhanced value strategies can be successful. Over the 1983-1991 period, a code plus strategy was used to advance residential building codes in the Pacific Northwest. The effort was spearheaded by the Northwest Power Planning Council and the Bonneville Power Administration (BPA) and involved many other utilities and agencies. The initiative included four steps: (1) developing model conservation standards that defined efficient and cost-effective construction practices in code language; (2) sponsoring demonstration projects that showed builders how to build to the model standards and evaluated the costs and benefits of the model standards; (3) offering incentive programs to popularize the new standards and give them a significant share of the market (these were marketed under the heading "Super Good Cents", a value-based message); and (4) passing new building codes based on the model standards by the Washington and Oregon legislatures (Watson & Eckman 1993). The entire effort cost Bonneville and other utilities over $100 million, but an evaluation of the effort determined that the entire effort cost approximately $0.02 per kWh including a utility cost of less than $0.003 per kWh (Schwartz 1993).

The enhanced value strategy is new in terms of utility programs, but there are examples of specific buildings that have used this strategy. For example, the 290,000 sq. feet Miller SQA building was designed to be a state-of-the art "green" building. Miller SQA is a manufacturer and vendor of office furniture that provides "just in time" furniture products for small businesses and nonprofit institutions. The building is a manufacturing plant, warehouse, and headquarters housing approximately 600 workers in the manufacturing plant and 100 workers in the office portion. Energy-efficient aspects of the building include large-scale use of energy-efficient lighting, daylight controls, and state of the art digital HVAC controls, including sensors, controllers, and data loggers. Green components include environmentally sensitive materials throughout the building, minimally invasive site utilization, enhanced indoor air quality, and extensive recycling. In addition, building materials were obtained locally whenever possible to reduce transportation costs and energy. The building now consumes 18% less energy than their previous building. Studies showed the new green building was associated with higher overall quality of work life than the old building (Heerwagen 1998). For example 16% of the office workers said they had headaches often or always in the old building while only 7% did in the new building. In addition, data from four of the Miller SQA performance measures (effectiveness, efficiency, quality, and total productivity) indicate there were small (typically less than 2%) increases in performance for at least five of the eight matched months. This can be highly significant to an organization in a competitive market.

The first commercial new construction program built solely on a value strategy began in May, 2000 and is operated by the Northwest Energy Efficiency Alliance under the title "BetterBricks.com." The program includes extensive media outreach to building owners and users, including office workers. The outreach effort emphasizes the comfort and productivity benefits of a quality office environment and refers people to a web site for more information. The web site provides information on strategies, and offers technical assistance services to building owners and designers (Harris 2000). Currently, the program offering is just a shell relative to the long-term vision; many program components still need to be worked out. Concrete results from this program will not be available for at least one year.

Conclusion

In the 1990s, commercial new construction programs were generally successful in delivering energy savings and changing construction practices. These programs have shown that it is possible to build beyond minimum energy codes and deliver cost-effective buildings to a significant portion of the marketplace. New construction programs, when coupled with strong minimum codes and code enforcement, have also helped raise minimum building practices beyond minimum code.

Relative to current commercial new construction programs, our proposed strategy differs in several respects. First, the code plus portion of our strategy more explicitly and directly attempts to influence the code process, which should lead to more rapid and more comprehensive code changes. Second, the enhanced value portion of our strategy is more market oriented than most programs today emphasizing measures that deliver significant value, beyond energy savings. Many programs today emphasize energy savings and mention value as a secondary consideration. We suggest these priorities be reversed. Third, we are suggesting greater integration between our strategies (e.g., a value-based marketing message discussing, good, better, and best practices) than most programs today.

To move programs better into the realm of market transformation, program designers should take advantage of the synergy between energy codes and beyond code programs. They also have to link their advanced energy efficiency targets to key marketplace values shown to motivate building owners. By viewing the marketplace in this manner, code, advanced design standards, and value-based marketing efforts can pave the way for a new generation of new construction programs that will continue to build upon the successes of the last decade.

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