An Improved Model for New Commercial Office Building Markets: Implications for Market Research and Evaluation

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ABSTRACT

The California Institute for Energy Efficiency and the Northwest Energy Efficiency Alliance recently sponsored research aimed at improving our understanding of new commercial office building markets. The findings suggest a much more complex market model than those that have traditionally informed energy efficiency program designs. This has important implications for evaluators and researchers interested in developing and evaluating new commercial building market transformation programs. In this paper we review key research findings. Based on these research findings we develop ideas for market indicators for successful market transformation initiatives in new commercial building markets.

Introduction

Johnson and Nadel provide a good overview of new commercial building energy efficiency programs (Johnson & Nadel 2000). These programs began in the early 1980's, spreading from California to the Northwest, Wisconsin, and New England. They were designed as resource acquisition programs and were intended to acquire energy efficiency resources at a cost that was less than the marginal cost of production. As more new commercial building programs came on-line in the early 1990's, this framework expanded to include "lost opportunity" resources – those resources only available at the time of construction. By the mid-1990's, electricity restructuring and other electricity market conditions led to the demise of many new commercial building programs. Those programs that remained, while still interested in resource acquisition, began to shift attention toward creating longer-term transformation in markets. This reflected growing policy interest in market transformation (Meyer, Hastie & Hu 1997; Prahl & Schlegel 1995).

With the turn to market transformation, however, it becomes clear that the emphasis of past research and policy has left us with large gaps in our understandings of how building choices are made, and how they might be changed. In addressing these knowledge gaps, Blumstein, Goldstone and Lutzenhiser (2000) suggest that:

> *New market connectivity and market transformation approaches to energy efficiency require a much better understanding of the dynamics of markets for energy-using goods than has been required by energy analysis and efficiency programs in the past . . . The design of effective MT interventions will require new mid-range theory and research on specific aspects of markets that are now poorly understood.*

Evaluation of resource acquisition programs focused on identifying the impact of the programs in terms of the energy resource acquired and its costs. Research considered which building sectors offered the greatest opportunity for savings, what technologies or standards should be incorporated into the program, and what types of incentives or support were necessary to generate participation in the program. The shift in interest to market transformation programs resulted in some studies to identify the effects of traditional resource acquisition programs on markets (Peters et al. 1998.). These studies applied the market transformation theory developed by Eto, Prahl, & Schlegel (1996) to consider market

effects, market barriers, and market opportunities. Several baseline market studies and assessments have been conducted to better understand current practices to support the development of future market transformation programs (RLW Analytics 1999; Borelli, Baylon, & Kennedy 2000; Heschong Mahone Group 2000). These studies provide a baseline for future market transformation programs and give an indication of current practices and attitudes. Recently, several research efforts and evaluations of programs focused primarily on market transformation in the new commercial building market have been completed (Reed & Hall 1998; Reed, Oh & Hall 1999, Research Into Action & Dethman & Tangora 2001, Reed 2001). These evaluations have taken a broader look at the market and what leads to change. They have expanded on the structure of the market and applied market theory on how market change occurs to guide their research.

Our intent in this paper is to contribute to the development of research and evaluation approaches to commercial new construction markets based on the research we have conducted. In the first section of the paper, we review the findings from our new commercial office building market research project. We consider the context for our research, key market concepts, and what our findings suggest for creating change in the market place that supports energy efficiency. Then we discuss the implications of our research for evaluators and researchers. We explore market research and evaluation issues regarding assumptions and methods. Based on our research findings on creating change in the marketplace, we develop ideas for market indicators of successful market transformation in these markets. These market indicators provide a starting point for identifying what to measure in a commercial building program evaluation.

Review of Research Findings

In 1998, the California Institute for Energy Efficiency commissioned a scoping study to identify important research needs for new commercial building markets (Lutzenhiser et al. 1998). The scoping study viewed commercial building markets "as complex, evolving networks of organizations and actors. Such market systems are characterized by multiple interests and perspectives (e.g., of owners, architects, builders, financiers, regulators) that interact in complex ways in the negotiation of designs and the production of buildings."

Given this market view, which is somewhat more complex than historical energy-efficiency industry views, the California Institute for Energy Efficiency sponsored a research project to increase the understanding of new commercial building markets to support better-informed interventions in those markets. The Northwest Energy Efficiency Alliance was a collaborative supporter of this research. This research was completed in June 2001 (Lutzenhiser et al. 2001) and provides the basis for the ideas presented in this paper. The following review of research findings considers the research approach, identifies key market concepts, and discusses creating change in the market place.

Research Approach

The New Commercial Office Building Market Study explored the question of "why" new commercial buildings are not more energy-efficient by empirically examining the dynamics of commercial building markets. The intent was not to provide prescriptive or programmatic answers, but rather to develop knowledge about the market sufficient to support strategic interventions in it. The study used multiple research techniques and data sources.

1) Findings from an extensive literature review including published work in the social sciences, architecture, urban planning, real estate development, and construction management.
2) Documentary source materials such as articles in the business and trade press and local newspapers.

3) Observation and interaction with market actors at conferences and trade shows.
4) In-depth ethnographic interviews with key industry informants.

We conducted over 80 interviews with bankers, developers, real estate brokers/marketing agents, appraisers, property managers, architects, engineers, energy efficiency and sustainability consultants, community and national NGO movement actors, builders, and regulators. We also identified a small number of specific building projects and made observations and conducted interviews with participants in these projects to better understand the development process. Our research focused on office buildings and was centered in four regional markets: Sacramento, San Francisco, Seattle, and Portland.

Interview notes, transcripts, and documentary materials were collected, summarized, shared, and ultimately categorized in terms of industry structure and dynamics, the delivery process, trends, innovation, and energy efficiency, with a host of subcategories under each heading. An integrated software product for viewing, searching, annotating, and highlighting information (Folio Views) was used to support this analysis effort and identify common themes and messages.

While the research was theoretically informed by work in economic sociology and institutional economics, we began our research with few preconceptions, attempting to enter the professional worlds of our industry informants. This allowed us to better understand the problems and constraints faced by various actors in the industry, as well as to build up a composite picture of industry dynamics and trends that is grounded in real-world experience.

Market Concepts

What shapes the form of buildings? This is a fundamental question for our research. Commercial building markets are dynamic, reflecting local geographic markets and economies as well as broader economic cycles. There are a number of factors that influence the characteristics and nature of the buildings that emerge from the real estate development process. We would like to highlight three important market concepts that we believe are important for establishing the context for energy efficiency in these markets. These concepts include the players involved in building development, the nature of buildings as investments, and the three factors necessary for successful building development.

Market Players. Historically, energy-efficiency and demand-side-management (DSM) programs focused on modifying the design of new commercial buildings by encouraging the adoption of better technologies or improved design strategies. Attention centered on building designers (architects and engineers) as key market actors in the adoption of more energy-efficient technologies and system designs in buildings. However, it is important to understand that the building development "industry" is in fact a series of linked industries that include a number of market actors that come together to influence and deliver a building product.

- Our research defined six major industry groups involved in the development process – providers of capital, developers, design and delivery professionals, community/political/regulatory interests, real estate service providers, and users[1]. Each of these groupings represents an independent industry. These communities of practice converge and overlap in the commercial construction process, yet they also remain distinct.
- Developers orchestrate the development process, representing the interests of providers of capital, managing the delivery team (designers and contractors) that produces the building, responding to community/political/regulatory requirements (represented through zoning, codes, and review processes), utilizing the support of real estate service providers, and responding to the requirements of building users.

[1] The term "user" does not refer to individual users of space (e.g. workers sitting at a desk), but rather the organizations and firms (and the individuals that represent those firms) that use and occupy commercial office building space.

- The building development process organizes the various industry groups and market actors in different ways depending on project requirements. Current industry trends for large projects are leading to hybrid delivery approaches that combine elements of design-bid, design-build, and construction manager delivery methods. These hybrid approaches require the involvement of most market actors early in the conceptual process to reduce risk and control cost while producing a high value product quickly.
- For the most part "upstream" actors constrain the choices and actions of "downstream" actors. In general, as decisions about building form are made upstream by developers and financiers about budgets, location, revenues, target markets, and so forth, downstream participants are increasingly constrained in their options concerning content—what designs and technologies will be implemented and what services will be rendered.

Buildings are Investments. They represent tangible assets that provide predictable income streams to investors looking for a relatively conservative investment. Yet building development is an inherently risky endeavor exposed to risk associated with the local market and the demand for space. Those in the real estate industry make money by correctly judging the market, its needs, and requirements and delivering buildings that produce reliable income streams to investors to justify their capital investment in the development.

The nature of buildings as investments fundamentally defines and structures the development process. Building developers strive to minimize the risk associated with the buildings they produce as described in the following statement from a property developer.

> *"There's always a risk in being a pioneer that you've made a value judgment that people want this and you're entirely wrong. They just don't want it. And nobody wants to take that risk and end up with a product that's not wanted. The investors look at you askance and say I'm sorry, it's not the model that's worked for me." (Property Developer)*

The use of models that have worked in the past was mentioned by a number of developers we spoke to as a way to reduce uncertainty and increase profitability. They rely on trusted networks of industry professionals with a proven track record for delivering the predictable sorts of buildings that they desire. They take a utilitarian approach to building design by stressing function and flexibility so that their buildings appeal to the market place and maintain their value. Value is determined by what the market is willing to pay as reflected in this statement from an appraiser.

> *"What we're supposed to do is simply reflect the market place. I mean, one of the ways I like to explain it is all we are is a mirror. If we're to find market value, even if the market place is doing what we think is a stupid thing, we have to say, this is what the market place is doing and this is how we think the market place is going to react and this is the price that we think the market place will pay." (Appraiser)*

Fundamentally, money is not made in the building development industry by producing products that significantly deviate from the norm. However, there are examples of unique and innovative buildings. Over time, the characteristics of buildings do change as developers respond to market requirements and opportunities.

Land, Capital, Users. Real estate development requires three things as described by this industry observer.

> *"You can look at real estate development as a three-legged triangle and it requires users, requires land, and requires capital. There is no project that succeeds with any two of those, and there it is. Every time someone has tried to build a project with two of these, ... it fails. So if you have the land and you have the capital, and you build something that the users don't express a preference [for] in terms of a lease...you die." (Industry Observer)*

In other words, there must be users that require building space, there must be investors willing to provide the capital for the building project in exchange for a financial return, and there must be land that

can be used in a manner that supports the project goals. The building developer must balance each of these elements. For a project to move forward, each element must be addressed early in the development process. There is a process of tradeoffs, negotiations, and compromises that occur throughout the process to reach a final outcome. What is ultimately built is shaped by the availability of each of these three elements and the requirements and constraints that they impose. When we consider change in the market place, we need to understand the requirements of these elements.

Creating Change in the Marketplace

While we are not convinced that successful market transformation is possible in new commercial office building markets, we believe positive change can occur.

- The building industry continues to change and evolve. This process of evolution can be prodded in more, rather than less, socially desirable directions.
- Some past and ongoing DSM efforts have achieved certain degrees of success. These efforts should be recognized and incorporated into future market transformation (MT) initiatives.
- Social scientists who have studied change in organizations, organizational fields/networks, and market systems tend to view firms and fields (networks of firms) as generally adaptable to change in macro and local systems—although the failure to adapt is a recurrent theme in the literature as well.

We believe, however, that effective DSM or MT efforts in such a complex, multi-actor, multi-interest system cannot be simple, but ought to attack the problem on multiple levels, in concert with the efforts of multiple market and non-market allies. It is not enough to simply introduce new energy-efficient technologies into the market place. The mechanisms for incorporating energy efficiency into buildings must change. We believe the change process must occur at three levels.

1. Making energy efficiency relevant. In order to establish the relevance of energy efficiency for market actors, the primary approach ought to be the linking of MT efforts to complementary building industry trends and interests, with the idea of making energy efficiency more visible as a tool for meeting industry goals.
2. Encouraging demand and institutionalizing energy efficiency in the market place. A key problem for energy-efficiency market transformers is creating an impetus for change in the market that leads to demands by owners, occupants, and investors for more efficient buildings. "Demands" are not abstract urges or wishes that can be shaped by information. They are concrete expressions of willingness to act in particular ways by concrete actors on the ground. Therefore, they are best encouraged and facilitated by efforts directed to specific actors in real markets.
3. Standardization within the development/design process. Conventional approaches to energy efficiency have involved the application of energy codes or efforts to encourage innovation in the building delivery process through adoption of new technologies and design tools. These later approaches do not consistently produce market change that leads to more energy-efficient buildings. Tendencies in the building industry to standardize and make things routine must be taken advantage of, rather than focusing on constantly trying to get the industry to accept innovative ideas.

These findings suggest that program strategies must be focused on issues that are relevant to the building industry and they must be targeted at specific market actors that have the ability to influence demand and supply. These strategies must be informed by an understanding of the market and must leverage existing trends and opportunities to establish relationships with key market actors. While these ideas are somewhat different than traditional perspectives used by the energy industry in program development, there is recognition that future commercial building energy-efficiency programs must

better reflect industry values. Recent research and evaluation work conducted by Reed, Oh, and Hall (2000) reached conclusions similar to those expressed above. In the remainder of the report we consider the implications of these finding for research and evaluation in new commercial building markets.

Implications for Research and Evaluation

Johnson and Nadel (2000) identify two basic commercial new construction program design approaches: (1) The component based approach that promotes the use of specific energy-efficient technologies; and (2) The performance based approach that promotes a minimum performance level for the overall building. These approaches employ various methods such as marketing, financial incentives, design assistance, guidelines, training, and coordination between various market players to achieve success. Also during the 1980's many jurisdictions adopted commercial building energy codes. The intent of these programs was resource acquisition. More recently, some utilities and non-profit, government, and market transformation organizations have initiated efforts aimed at transforming the market. These efforts have included marketing, policy development, and creation of peer networks and resource centers that provide information, technical assistance, and training to support the design of more energy-efficient buildings.

The nature of these commercial new construction programs set the context for the research and evaluation that supported them. We identify several research and evaluation issues to consider as programs strive to create broader market impacts. Then we discuss ideas for market indicators that can be used to identify these broader market impacts.

Research and Evaluation Issues

The assumptions and methods that set a framework for evaluation and research also set the boundaries for the questions that are asked and the answers that are obtained. Historical energy-efficiency paradigms have led to analysis, research, and evaluation that focuses on building technologies, energy use, and costs, while holding constant or ignoring a range of other factors involved. These other factors are particularly relevant when the goal is to create broader market change. In light of our research findings, we believe it is important to consider how historical *assumptions* and *methods* can limit the ability of evaluation and research to support broader market change.

Assumptions. We believe two assumptions underlie much of the previous commercial building research and evaluation work. These assumptions were appropriate given the program designs noted above, but they confound a deeper understanding of energy-related innovation (and failure to innovate) in the commercial building market. The first—which is rooted in the historical energy view of the market—sees the problem as centered in *design*. New commercial building programs have focused on changing the design of buildings using component or performance based approaches. As a result, research and evaluation have tended to focus on those actors involved most intimately in the design and construction process, namely architects, engineers, and to a limited extent contractors. In the process, much of the complexity of this market place has been ignored. As noted, our research identifies six groupings of key market actors that play various roles in the development process. Design and delivery professionals are only one of these groups. It also suggests that design is only one aspect of the development process, with other phases in the process having an equal if not greater impact on the final building outcome.

The second assumption is related to the first. It assumes that market actors (firms and individuals) have a great deal of autonomy from outside influence and other social networks when making decisions. Yet our research indicates that models used by the industry as well as the constraints

and requirements imposed by the availability of land, capital, and users significantly limit the autonomy of market actors and what gets built.

These assumptions limit our appreciation of the complex, interactive, and socially rooted nature of decision making in this market context. They tend to flow from an energy-centric view that does not consider the broader market context. This can result in the measurement of things that have little to do with long-term change in the market. Instead evaluations need to be rooted in a reasonable theory or model of how the market works and less on program theories or visions of how the program implementers think the market works.

Methods. Traditional energy-efficiency industry research of the new commercial building market has tended to rely on structured survey approaches and moderate sized samples of design professionals and owners with quantitative presentation of results. While these approaches offer a high degree of *reliability* because results can be compared across sizable samples, we believe the results can have limited *validity* and offer little guidance for the development of effective market transformation programs. Quantitative survey methodologies require a detailed knowledge of the phenomena in which we are interested before valid questions can be posed to respondents. For simple or focused research, this may be relatively straightforward. However for more complex issues related to creating market change this is a significant challenge. Through preliminary literature reviews and consultations with industry observers, we realized that very little empirical research has been conducted on commercial buildings markets. From those sources we also came to realize that the systems involved were likely quite complex and nuanced in their operations. Without well-developed knowledge about the market, questions are unlikely to get beyond superficial understandings and assumptions and they are likely to produce results that are not particularly useful, and are sometime actually invalid.

Qualitative research approaches are often overlooked and underutilized by the energy-efficiency industry. Qualitative methods are appropriate for developing a valid understanding of the new commercial building market. These approaches allow for the in-depth research necessary to understand complex market structures and processes and produce the findings that provide the basis for program development and for further research and evaluation efforts.

It is our view that effective market research, particularly when careful analysis of documentary materials and ethnographic interviewing are used, can provide a solid foundation for program design and evaluation. We prefer to label this approach "market operations research," since it's aim is to go beyond conventional market research interests in consumers, niches and products, to consider the structure and dynamics of whole market systems. Evaluation techniques will need to continue to evolve as well in the market transformation context, moving away from methods intended to identify participant or program impacts, and toward methods intended to identify market impacts. In this, sound research provides the necessary theory to identify what the evaluation should measure.

Market Indicators

The intent of market transformation programs is to create lasting structural and behavioral changes in the market that lead to greater adoption and delivery of energy-efficiency products, practices, and services. Because of the broad nature of these programs and markets, it is very difficult to directly measure energy impacts. However, a sound market theory can identify market changes that support greater energy efficiency. By measuring these market changes or market effects, some measure of the success of the market transformation program can be obtained.

The following discussion of market indicators presents ideas about measures for new commercial building market transformation evaluations. The nature of indicators for a particular program will depend on the goals of the program. However, market transformation programs are not usually limited

to a specific geographic location and can benefit from broad indicators that rely on collaborative research and evaluation and ongoing collection of information.

The market indicators are grouped based on the three mechanisms of market change identified in our research – relevance, demand, and supply. We have also added a fourth category of energy-efficiency indicators to suggest the need for developing some broader measures of energy efficiency. While we have grouped the indicators in these categories for ease of presentation, they are very much interrelated.

Relevance Indicators. Is energy efficiency relevant to market actors? Is it viewed as a tool to solve industry problems? Our research on commercial buildings suggests that it is not relevant in this context. To establish the relevance of energy efficiency to market actors, program strategies need to link energy efficiency to complimentary interests of building developers and users. Complimentary interests identified in our research include: the movement toward green and sustainable buildings; growing interest in quality work environments to recruit and retain employees; the application of advanced building technologies and controls for management, security, and comfort; and concerns about energy price volatility and reliability.

The fundamental question that needs to be addressed is whether views of energy efficiency by key market actors are changing. One key aspect of this is ensuring that the right message is getting to the right market actors. At one level, this may simply involve assessing the effectiveness of a marketing effort. This could include testing of new messages. Are the messages getting out? Are they being heard by the right actors? Are they being delivered by the right people? Is the message getting across? Is it the right message?

However, more than just marketing is necessary to establish the relevance of energy efficiency. Perhaps the most important relevance market indicator is adoption of the message by the key market actors and institutions that act as intermediaries. Are real estate brokers using and spreading the message as a way to market and sell space? Are peer organizations of users and the building industry further developing and documenting the message for the benefit of their members? Is the trade press spreading the word on the relevance of energy efficiency to their readers?

Demand Indicators. Efforts to create demand must be targeted to specific market actors where market transformation is most likely. Examples include progressive regulators, large institutional building users, vertically integrated property development and property management firms, and institutional investors. The key question is whether these key market actors are taking action to institutionalize demand for energy efficiency in commercial buildings.

An evaluation must determine if the target actors are being reached. Market indicators could consider the total universe of a certain market actor or firm and the portion that is influenced by the program. For example, if the target was large vertically integrated property development and management firms, one might consider the amount of floorspace controlled by participating firms. The Energy Star Buildings Program is an example of a program where this type of measure would be relevant.

An evaluation must also consider whether targeted actors are taking action to institutionalize demand for energy efficiency. The nature of these market indicators depends on the targeted market actor/firm and the program theory. Using the results of our research, potential examples of market indicators might include:

- Progressive Regulators: Creation of regulatory incentives by regulators that encourage developers to adopt higher levels of energy efficiency.
- Large Institutional Building Users: Development of work environment standards by users that include energy efficiency as a tool for improving the quality of the work environment –or– Users require that all new building projects meet a performance standard such as LEED

(Leadership in Energy and Environmental Design developed by the U.S. Green Building Council, USBG 2000).

- Vertically Integrated Property Development and Management Firms: Firms develop policies and standards that ensure energy or resource efficiency is incorporated into development and management processes for maintaining the long-term value of property –or– Firms adopt performance benchmarks that ensure energy efficiency will be included in property development and management.
- Institutional Investors: Energy efficiency or sustainability is an investment criteria used by real estate investors that value social responsibility.

Finally, the evaluation should consider the extent of influence of the action taken by the market actor/firm. For example, the impact of an individual large institutional user may have less impact than if the peer organization took action. However, if the action is taken by a firm that is a market leader (e.g., Microsoft) the influence may be dramatic and reach well beyond firms participating in the program.

Supply Indicators. Rather than trying to get the building industry to accept innovative ideas, the tendencies of the industry to *standardize* should be exploited to "build-in" efficiency choices. The fundamental question is whether energy-efficiency choices become standardized in the delivery process.

Our research identified a trend in the building delivery process towards involving and bringing together more of the members of the design and development team very early in the process. This provides the opportunity for more market actors to have a seat at the table, including those who might have strong energy-efficiency or sustainability credentials. Whether it becomes more routine for individuals with these credentials to be included early in the process is one potential market indicator.

The building industry is increasingly using information management technologies, the Internet, and integrated computer aided design tools and databases to improve the efficiency of the delivery process and the quality of buildings. An important market indicator is whether energy efficiency is being included in the improved processes and tools the industry is developing. Is energy efficiency being used as one of the tools in these process improvements to achieve industry goals?

These process improvements, along with the adoption of quality assurance practices such as building commissioning, have the potential for improving the performance of buildings. Market indicators could consider whether this improvement in quality is occurring, particularly in terms relevant to the building industry. The next question is whether this improvement in quality also leads to higher energy efficiency. Also, these quality assurance processes provide an important feedback mechanism. Determining how and whether this feedback mechanism is leading to further improvements in building quality is important for understanding market change.

Our research has identified a number of progressive design and contracting firms that have developed a portfolio of services supportive of energy efficiency and sustainability throughout the building life cycle. A relevant market indicator is whether the universe of these firms and the services they offer continues to expand.

Appraising the value of a construction project is a critical step in determining its economic viability and current appraisal standards give short shrift to the lower operating costs of an efficient building. This reflects the lack of market value for energy efficiency. The degree to which appraisal standards begin to account for the value of energy efficiency in buildings is an indicator of market change.

Several ongoing efforts by utilities, university and industry groups, and environmental NGOs are aimed at producing design guidelines and metrics for green construction (e.g., the U.S. Green Building Council's LEED rating system, see USGBC 2000). Efforts to develop voluntary standards that go beyond energy code requirements have existed for some time. The degree to which any of these voluntary standards becomes widely adopted, thus lifting standard industry practice, is another potential market indicator.

Energy Efficiency Indicators. Evaluation of new commercial building resource acquisition programs focused on measuring program impacts – the energy attributable to the program. How do we look at gains in energy efficiency at a market level? The bottom line question even for market transformation programs is whether buildings are really more energy-efficient. Do they use less energy?

Market baseline studies (RLW Analytics 1999; Borelli, Baylon, & Kennedy 2000) indirectly answer this question. By identifying building characteristics and standards of practice, these studies can suggest that energy efficiency is improving if standards of practice are improving. This is valuable information for assessing the impacts of market transformation efforts. Baseline studies have particular value in assessing the impact of energy codes. However, these studies cannot account for all the building characteristics that impact energy use and unless they also collect and analyze actual energy use data, they are limited in what they can say about actual building energy efficiency.

Ultimately, there is a need to systematically collect and analyze actual commercial building energy use data. The Energy Information Administration does collect energy use data as part of their Commercial Buildings Energy Consumption Survey (EIA 1998). Tables 1 and 2 present two market level views of energy use in commercial office buildings based on EIA data. In Table 1 we see what appears to be a dramatic improvement in the efficiency of the commercial office building stock between 1983 and 1986. Table 2 shows that in 1995, office buildings constructed between 1990 and 1995 use less energy than older buildings. This might suggest improvements in the efficiency of new buildings. However, it is important to understand the limits of these data. When viewing sub groups of the EIA data, sample sizes are relatively small and the standard errors for the survey values are quite large. Thus the apparently large difference in the values between 1960-89 and 1990-95 in Table 2 is not statistically significant at a 90% confidence level. However, we believe there would be great value in collecting this type of information over time using sample sizes that produce results at a level of accuracy and resolution to indicate important market energy-efficiency trends.

Table 1. Commercial Office Building Energy Use Intensity by Year

Year	1979	1983	1986	1989	1992	1995
EUI (kBtu/ft^2-yr)	123	122	106	104	101	97

Source: Commercial Buildings Energy Consumption Surveys

Table 2. Commercial Office Building Energy Use Intensity in 1995 By Year Constructed

Year Constructed	Before 1959	1960-89	1990-95
EUI (kBtu/ft^2-yr)	95	100	84

Source: Commercial Buildings Energy Consumption Surveys

We have presented ideas for a variety of market indicators for successful new commercial building market transformation. We believe these indicators need to be considered as part of a portfolio of measures. The value of any individual measure is limited since the strategies for creating supply and demand in the market place are linked. Also it is important to recognize that application of these indicators should not be limited to particular programs and specific moments in time. In order to identify market effects, data must be collected in a consistent manner over time.

Conclusions: Supporting More Effective MT Programs

A long-standing tenet of evaluation research holds that strong program interventions and strong evaluations depend upon the strength of the *program theory* used by program designers (Weiss 1997).

This program theory must be based on sound market theory. If this fails to occur, program theories are likely to be based on limited perceptions of the market and evaluations will exclude key market indicators of success. In this paper, we have presented concepts from our research that lead to an improved *market theory* for new commercial building markets. Based on this theory, we have suggested a set of indicators of market change. It is our hope that these theories and indicators will support the development of program theories and strategies for effective market transformation programs. Application of these market indicators in ongoing evaluation and research activities will lead to improved theories and better programs that respond to changing market conditions.

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