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HOME ENERGY RATING SYSTEMS: AN ANALYSIS OF A VOLUNTARY DEMAND-SIDE MANAGEMENT PROGRAM

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INTRODUCTION

In the last few years, demand-side management has become one of the most important activities conducted by utility companies and local and state government agencies in their planning and evaluation of energy conservation programs. The principal objectives of demand-side programs are to reduce energy consumption and to change load shapes (as reflected in changes in the time pattern and magnitude of a utility's load) by actively influencing consumer demand for electricity, through such programs as load management, strategic conservation, rate innovation, and marketing. The programs often rely on voluntary participation by consumers, and utilities and governments commonly offer a wide range of inducements to encourage participation. The effectiveness of these programs and inducements depend on an indepth understanding of consumer needs and "perspectives" which need to be constantly assessed during program implementation. As an example of how these needs are assessed and addressed in a voluntary demand-side management program, we present findings from our recent survey of home energy rating programs currently being conducted by utility companies, governmental agencies, and other organizations.

HOME ENERGY RATING SYSTEMS

The rating and labelling of new and existing energy-efficient homes by local, state, and federal government agencies, utility companies, and other organizations has been an activity marked by periods of intense interest and benign neglect. During the late 1970's, home energy rating systems (HERS) became important components of several energy conservation programs conducted by governmental and non-governmental organizations at national, regional, and local levels. By 1982, when the first national review of HERS was prepared, it seemed that the idea of a home energy rating system had become entrenched as an effective means of pursuing the goal of energy conservation (1). Since that time, however, a number of these systems have been abandoned, and only a few have endured. Nevertheless, a number of HERS remain, and interest in HERS has increased in selected areas (notably in Alaska, Arkansas, Colorado, New Jersey, New York, Vermont, Washington, and Wisconsin). Accordingly, HERS remain viable, strategic energy conservation programs that should be essential components of anyone's demand-side management philosophy. In the following discussion, we describe the distribution of these programs around the country, present our major findings, and describe the various needs of the individuals and organizations affected by HERS and how they are addressed in the implementation of HERS.

HERS DISTRIBUTION

In January 1986, we conducted a national telephone survey of home energy rating systems to examine the different kinds of HERS and implementation systems being used and to discover the range of possible implementation problems and solutions experienced by the users of these systems (2). Because of our interest in a statewide HERS, we first contacted all state energy offices in the U.S. to discover where existing HERS were operating. Major systems were followed up in each state, and we examined those operated by local governments and utility companies. Because we were primarily interested in obtaining a description of only one HERS per state, we did not normally investigate additional HERS in a particular state if that rating system was a duplication of one already reviewed. As a result, 28 states were able to provide examples of some form of HERS that was currently in operation.

The 28 states provided information about 34 HERS programs (Table 1): 13 of these were located in the southeast, 8 in the midwest, 5 in the northeast, 4 in the Pacific/mountain region, and 3 in the southwest. Although our sampling procedure was crude, we believe that this distribution accurately reflects the distribution of HERS through the country and the full range of likely implementation and delivery programs. They seem to be concentrated mainly in those areas concerned with regulating cooling loads. Most (20) of the programs were developed at the national or regional level, 6 by states and 7 by large utility companies or energy production and distribution authorities, as compared to the local level, where 14 HERS were developed, usually, by smaller utilities. However, the role of utilites should not be overestimated. Home builders associations, in particular, have tended to play a critical role in the adoption of most successful programs, are often used in consultation within the development phase, and have helped implement some of the major HERS in operation.

HERS FINDINGS

The first critical observation, based on our survey, is that it is virtually impossible to treat HERS in isolation from other energy conservation efforts. In particular, HERS' connection to auditing is often complex and inseparable. The promotion of HERS is intimately connected to the promotion of energy efficiency, and HERS are rarely offered in isolation. More frequently, a HERS is a part of an energy-efficiency package that might include anything, from free-sizing services and air-duct distribution design to free or subsidized weatherization materials and low-cost loans. This has made our task more difficult, since it means that, effectively, the study of HERS resists being reduced to a

conveniently discrete subject matter; it resists separate examination in order to determine its independent contribution to demand-side management.

This diversity in implementation is in part a consequence of the diversity in the target populations which range from homeowners and homebuyers (consumers) to real estate appraisers. Moreover, different expectations for, and uses of, HERS exist within these groups, and these differences affect the kinds of strategies evolved for successful implementation of HERS. Often, in the development of a particular program, the different goals and interests of participants need to be reconciled through negotiation; the alternative being the withdrawal of support by critical parties, or even the development of rival systems.

The success in implementing a HERS is dependent on success in *marketing* the HERS. Successful marketing is achieved only after a comprehensive appreciation and treatment of the diversity in target populations. Programs that have had a restrained approach to the implementation of HERS--by insisting on treating implementation problems as technical, engineering problems (e.g., focusing on the accuracy of the tool), or by taking a laissez-faire approach to marketing (e.g., simply meeting a demand for energy efficiency, rather than helping to create more demand)--or programs that have adopted an aggressive, non-responsive approach, have had a poor track record. Successful implementation requires: sensitivity to the diversity of the market; an active approach to marketing; an appreciation of the range of different uses of HERS and the range of apprehensions felt by the various target groups; and the willingness to be responsive to the major user groups in the administration and further development of the program. The rest of this paper discusses the perspectives and needs of the individuals and organizations affected by HERS and the solutions used to address their needs.

NEEDS AND SOLUTIONS

Homeowners and Home Buyers

In considering consumers' (homeowners and home buyers) interests in a HERS, it is apparent that their aims or motivations were primarily based on costs and their desire for physical comfort. HERS programs have in the past been promoted to these groups through an emphasis on energy efficiency, yet accumulated evidence seems to suggest that this motivation plays little part in either home-purchasing decisions or decisions to retrofit. Much more important to them are the costs of energy and the provision of thermal comfort. Saving through energy efficiency has been a successful promotional device,

but there is still a widespread belief, especially for low-income groups, that energy-efficiency and cost savings can only be achieved with reduced thermal comfort. This belief is one of the main barriers that must be overcome in dealing with the general public. To this end, recent promotional programs have focused on the thermal comfort advantages of energy-efficient homes, and rebates have been offered to builders to promote the correct sizing of air-distribution systems, and, therefore, make the homes more comfortable. To date, these strategies have been particularly successful.

The kinds of economic factors considered in investment decisions by consumers include the size of the investment, its effective rate of return in terms of annual savings on energy bills, the repayment period, the capital appreciation of their property accruing as a result of energy-efficient improvements, and the related change in the resale value of their property. In response to these concerns, HERS sponsors have used educational programs, rebates, guaranteed savings, and lower utility rates to assure consumers that they will be definitely saving energy and money by investing in energy-efficient homes. It is important to note that different socioeconomic groups seem to have different criteria for making an investment decision. The time frame for repayment is more restricted in the case of low-income groups, and no group seems to have a time frame nearly as long as the 'conservatively short' periods used in the cost-effectiveness calculations of most HERS developers. HERS developers use a 7-year time frame, while consumers prefer less than 6 months for smaller investments, and only up to 5 years for larger ones (and this time frame is even smaller for low-income groups).

Consumers are also dependent on energy authorities for providing them with information about the economic benefits of energy efficiency, how they might be affected, and what their cost will be. Vague information is typically inadequate for making a rational investment decision, so that HERS should be as adaptable and as specific as possible. Problems with the accuracy of the tool as it relates to the reliability of savings predictions for the individual consumer can be successfully buffered through the offering of securities, in the form of guarantees, lower energy rates, or rebates on more efficient equipment.

Highly related to these issues is that of the trustworthiness of the HERS sponsor. When the sponsor is a utility, consumers are suspicious about the potentially contradictory objectives of the organization: make money by selling energy versus decrease energy consumption by promoting HERS. Consumers do not readily see the connection between

energy efficiency and the profitability of utility companies. Consequently, consumers (especially, low-income groups) become suspicious of energy-efficiency programs. Such suspicions can be alleviated through the use of educational programs that promote not only energy-efficiency investments, but explain the interest of the implementing authority in them. The offering of actual guarantees (e.g., rebates, guaranteed savings, and lower utility rates), used to assure the investor of a real return, has the secondary consequence of reinforcing the trustworthiness of the agency.

Builders

Builders are generally very conservative and resistant to the introduction of novel ideas and technologies. New, energy-efficient technologies need to be tactfully introduced, or builder resentment of 'outside' intereference will prevent their widespread adoption. To this end, the implementation of HERS, in particular those designed for new construction, must be sensitive to the needs of builders. Through educational programs, builders need to be convinced that HERS sponsors have a legitimate interest in promoting energy-related building technologies so that HERS can be seen as acceptable activities and not as attempts to arbitrarily intrude on the builders' domain. Having convinced the builders of the legitimacy of their interest, the strategy of HERS sponsors has been to work with builders as 'partners,' not infringing on the traditional prerogatives of the building trade. This 'partnership' approach has strongly characterized most successful HERS programs and has been repeatedly identified by the administrators of such programs as a critical factor in their success.

Builders operate by the profit motive, and both the cost-effectiveness of HERS and their ability to be used as effective marketing devices need to be demonstrated. Typically, building to HERS standards within a HERS program costs money, time, and effort. For example, many programs charge a fee for participants, which seem to be regarded as generally prohibitive, regardless of the actual size of that fee. Also, new building materials and techniques require new skills, which have to be acquired and paid for, and HERS programs often involve a series of inspections that entail much effort on the part of the builder. In short, HERS can be very demanding of builders.

Builders are uncertain as to how a HERS will affect the marketability of their product. Typically, building to a higher HERS standard translates into added costs of several thousand dollars. If costs do increase, the builder is going to be concerned as to how this can be passed along to the consumer. He is concerned with the elasticity of the demand

for his product, and, hence, is ultimately dependent on the consumer's interest in energy efficiency. HERS sponsors have typically responded to this need of the builder by providing a marketing program, offering cooperative advertising, and independently promoting individual builders participating in the program. Furthermore, energy-efficient construction is often accompanied by decreased sizing requirements for various equipment (often as an inducement to the builder), and this can generally translate into reduced costs to the builder. HERS agencies also offer rebates to builders for installing energy-efficient equipment. To increase their understanding of HERS and energy-efficient construction, informational and training programs, workshops, and the construction of demonstration homes were targeted to the building community.

Some of the biggest advantages of participating in a HERS have occurred in depressed housing markets. When demand for housing is high and supply low, builders can usually sell whatever they build and, therefore, are not interested in participating in HERS. But when the housing market is depressed, energy efficiency can be used to increase the marketing advantage of participating builders.

Two groups have been very active in encouraging builders to support and participate in HERS, and their involvement has given credibility to rating and labeling programs. The first group consists of 'innovators,' the 'Young Turks' of the trade, whose commitment to energy efficiency has paid off in economically depressed times. The second group is composed of homebuilders associations (local and national) who actively research the market, promote the success of building innovators, and help develop local and regional HERS. Homebuilders associations are generally committed to energy efficiency and strongly support HERS programs.

Realtors

HERS have basically been directed to new construction and, most typically, to large construction projects. Under these conditions, sales are usually made by sales department personnel connected to the developer and not by independent realtors. Consequently, realtors are often ignored. In addition, realtors are often perceived as part-time or transitory workers and, consequently, represent a shifting target group. Because realtors have a high turnover, requiring continuous education, educative efforts are often "wasted." Nevertheless, for HERS that are directed at existing construction, a largely untapped area, a key to successful implementation in this sector continues to be the real estate agent.

The most effective strategies directed to realtors have been educational. Realtors that use HERS in selling houses can often increase their competitive edge by being more knowledgeable and more concerned with the future comforts of the prospective buyer. The National Association of Realtors assisted in the educational process and gave some credibility to the program. Energy-efficient houses also usually sell at a higher price, and higher prices translate into higher commissions for the realtor. When HERS are accompanied by recognition from the secondary lending community (Fannie Mae or Freddie Mac), the buying market is expected to increase, as lower-income households are helped in home purchasing through lowered income-payment ratios. The plausible house price range for all income levels actually increases, as they can finance more expensive property. All of this can translate into more commissions to the realtor.

Primary and secondary lending institutions

There is little evidence of the impact of secondary lending institutions (Fannie Mae and Freddie Mac) on home buying. Primary lenders, the local banking and credit union institutions, can potentially have a greater impact since their contacts with consumers are closer. However, relatively few banks actually consider energy efficiency in their lending decisions. Consequently, Freddie Mac and Fannie Mae endorsement has mainly been of great marketing value to the HERS agencies in dealing with recalcitrant builders, or in arguing the potential of HERS to realtors, than in creating greater demand for energy-efficient housing by the general public. Homebuilding associations, in particular, have successfully used the marketing argument with their members. Actual research on the number of loans made consequent to the use of energy efficiency information is sorely needed.

HERS Raters

In terms of HERS delivery, the two major vehicles are utility representatives and builders. To a large extent, the appropriateness of the rater is determined by the type of HERS in operation, since different types of HERS place different requirements on the delivery operation. Simple prescriptive systems can be constructed to allow mimimal training and can often be used by the consumers themselves. Calculational systems either require more detailed data (e.g., building blueprints) or are more complex in their calculational methods (requiring special training). Detailed information can usually be supplied by the builder, and, in such cases, builders become the default raters; special training requirements usually require utility raters.

Three other delivery systems are city building inspectors/auditors, real estate appraisers, and associated energy service industry experts (e.g., insulation specialists). Using city officials is often efficient if the HERS can be connected with an existing residential auditing or inspection program; however, because of potential liability and conflict of interest problems, building inspectors are seldom used. The major problem in using appraisers as raters is that the actual appraisal occurs late in the home selling process, so that the appraiser's rating has little effect on whether a house is sold or not. In addition, appraiser ratings may cost as much as $100, and this added expense may be seen as a major detriment.

Some very successful HERS have been developed and aggressively marketed by engineering companies specializing in energy efficiency or insulation. Local dealers or franchise owners, after specialized training, perform the rating in conjunction with the marketing of particular conservation services. To date, these activities have been mainly directed to new construction, which is easily accessed and involves large-scale sales. More recently, existing stock has been suggested as having a larger potential, and a greater stability, particularly in depressed housing markets.

It seems to us that a critical factor in the delivery of HERS has to do with the perceived authority of the rating agent. Simple HERS seem attractive in that they are easy to use, inexpensive, and allow consumers to perform their own ratings. In these situations, there is no information about effective implementation rates for retrofit procedures as a consequence of the rating process. If the HERS intends to be separate from the auditing process, the authority of the rating will still be critical for its acceptance and will be used by the consumer to judge whether the HERS is simply a marketing gimmick or provides critical information. Rated homes have to be seen as very effective investments, representing genuine improvements in thermal comfort with energy-saving advantages over other alternatives. We suspect that single sheets of paper and a simple calculation with mimeographed comments to aid the interpretation of results are not going to be very compelling. The results of a HERS rating should be clear and the recommendations should be precise, but they should also have the appearance of authority in order for them to be accepted and acted upon.

CONCLUSIONS

In conclusion, HERS that are actively marketed, have a comprehensive appreciation of the market, are adaptive to the needs of particular users, and include user participation in the operation and revision of the program, are more successful in terms of penetration rates and in improving the energy efficiency of the older housing stock. Where successful, HERS have penetrated an estimated 40% of the new construction market and 20% of existing construction, and energy savings have ranged from 10% to 50%. These savings do not take into account the impact of HERS on non-participants, so that HERS are more successful than indicated by the direct savings alone.

REFERENCES

1. P. Hendrickson, B. Garrett-Price, and T. Williams, Overview of Existing Residential Energy-Efficiency Rating Systems and Measuring Tools. Richland, Wash.: Pacific Northwest Laboratories, No. 4359, 1982.
2. E. Vine, B. K. Barnes, and R. Ritschard, Implementation of Home Energy Rating Systems. Berkeley, Calif.: Lawrence Berkeley Laboratory, LBL-22872, February 1987.

Table 1

HOME ENERGY RATING SYSTEMS SURVEYED

Alabama Power : Good Cents
Energy Rated Houses of Alaska
Salt River Project (Arizona) : Energy Efficient Homes
Arkansas Power and Light : Energy Efficient Rating:
Denver Energy Resource Center (Colorado) : Home Energy Rating
Conn Save (Connecticut) : Cornerstone Home Energy Rating
Florida Energy Proficiency Award
Gulf Power (Florida) : Good Cents
Georgia Power : Good Cents
Illinois Power : NEW
Delmarva (Delaware, Maryland, Virginia) : Super E Home
Mass Save (Massachusetts) : Mass Save
Mississippi Valley Gas : Gas Mark
Mississippi Power and Light : E3 and Energy Saving Home
St. Louis Home Builder's Association (Missouri) : Energy Mark Program
Union Electric (Missouri) : NEW
Kansas City power and Light (Missouri) : Save America's Valued Energy
Nevada Power : Energy Efficient Homes
Southwest Gas (Nevada, Arizona) : Flame of Excellence
Public Service Company of New Mexico : SMART
New York State Department of Energy : Thermal Rating
Duke Power (North Carolina) : Energy Efficient Structures
Ohio Department of Energy and Conservation : Home Energy Analysis Audit
Oklahoma Natural gas : Conservator Home Award
Pennsylvania Governor's Council : Home Energy Cost Estimator
Tennessee Valley Authority : Super Saver Homes
Watt Count Engineering
Texas Utilities Electric Company : Energy Action Homes
Gulf States Utilities (Texas) : Good Cents
City of Austin (Texas) : Look for the Star
Virginia Power : Energy Saver Home
Western Resources Institute (Washington) : Energy Rated Houses
Wisconsin Division of State Energy : Energy Auditing Program
Wisconsin Electric power Company : Good Cents

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