## Barriers to the Adoption of Energy Efficiency in Low-Cost Housing Production

Barbara A. Miller, National Affordable Housing Network

Adequate energy efficiency is often overlooked in the design and construction of most low-cost housing developed in the United States today. While barriers to implementation of energy efficiency in the American public housing system have been studied to some degree, little work has been done to explain the slow transition to efficiency in the rest of the low-cost housing sector. This paper reports the results of an assessment of the state-of-the-art of energy efficiency and barriers to adoption of energy efficiency across several housing sectors, including private, non-profit housing and American Indian housing. Experiences of organizations attempting to work on this problem will be evaluated, as will model programs developed to overcome some of the barriers to efficiency. Recommendations for public policy and program design purposes will be presented.

## Introduction

For a variety of reasons, energy efficiency is overlooked in the design and construction of most low-cost housing developed in the United States today. While the need for efficiency may be greatest in low-cost housing, given the strapped means of its occupants, the opportunity for energy savings of some 130,000 low-cost housing units developed by the private sector<sup>1</sup> (excluding manufactured housing) is lost each year. At present, the United States has no comprehensive, integrated federal program to substantially upgrade the efficiency of low-cost housing production. While our nation has a cost-effective lowincome weatherization program [Brown et al. 1993] that expends about \$300 million annually in efficiency (usually with savings of less than 25 percent) for about 180,000 units of existing housing, no companion federal program to target housing in the development and construction phase currently exists. Yet, large scale demonstrations in the Pacific Northwest and Canada have proven that adding the most cost effective energy efficiency measures in new construction or major rehabilitation typically can provide space heat savings of more than 50 percent at similar levels of per-unit investment.<sup>2</sup>

The Canadian government has such a new construction program, now more than 15 years in existence, that has substantially changed the building practice in Canada. Indeed, the Canadian R-2000 program has met initial energy savings targets, and new savings goals have been set with the Advanced Home program, which, for the first time, is targeting affordable or lower cost housing along with housing for the more affluent. Conversely, Canada has no national low-income weatherization program.

In the U. S., private-sector low-cost housing producers may (or may not) interact with a range of programs, including a wide variety of utility programs, statewide and utility home energy rating programs, energy-efficient mortgage programs and several state-level efforts that include incentives or standards that encourage greater efficiency in new construction. Utility programs include more than 300 rating programs, power marketing programs and a number of residential demand side management DSM efforts (Flur and Markle, 1992).

These programs can have conflicting technical advice for housing producers, calling for different technologies, different savings targets and a lack of agreement as to what actually constitutes energy efficiency. Like the Canadian R-2000 used to be, these programs are generally targeted more toward the custom homebuilding market than the low-cost housing producer, who typically will have a much narrower range of options given first-cost constraints and on-going maintenance issues.

The result is a patchwork system where most of the lowcost housing producers fall through the cracks. In order to study the need for a change in policy and to start the process of programmatic development to meet these challenges, a representative group of housing producers on the national level and the local level were surveyed to provide an assessment of the state-of-the-art of adoption of energy efficiency, and one major national housing organization agreed to begin trying to change toward energy efficiency. The barriers these organizations face are substantial, and they demand innovation in public policy and program design to begin bringing order to the chaos that is represented in the energy efficiency in new construction arena in the U.S.

#### Survey Overview

The Energy and Housing Programs at the National Center for Appropriate Technology (NCAT) surveyed 32 local or state-level housing organizations, selected by their membership in the HandsNet network. This number represents slightly under 10 percent of housing organizations registered in 1993 with HandsNet. Of this number, 15 represented Indian Housing Authorities. This survey of housing organizations was conducted in Summer 1993 as a part of a larger needs assessment survey that included Weatherization Assistance Program directors in 49 states and 91 leadership community action agencies or weatherization service providers recommended as "advanced" by the WAP directors in each state. Most surveys were conducted by phone, with each organization's director or weatherization director being directly interviewed.

In selecting this group to survey, it was assumed that by interviewing the "leadership" groups, a picture would emerge of the "best case" in terms of the needs assessment, for both community action groups and housing organizations. From this, it could be concluded that other housing groups would likely have a greater level of need.

This survey followed face-to-face interviews with leaders of a number of national housing organizations concerning their attitudes and recommendations about adopting energy efficiency into construction projects under their control.<sup>3</sup>

Finally, direct communications were conducted with more than 100 local affiliates of the Habitat for Humanity International organization during the 1991-94 timeframe. This represents more than 10 percent of the total affiliates currently on record with Habitat.

#### Results

#### The Energy and Housing Survey

Unlike the Weatherization Assistance Program directors and the weatherization service providers who were generally eager to complete the survey and give their opinions and state their needs, the housing organizations we contacted were, as a group, reluctant to discuss their needs and often expressed discouragement over their lack of resources to address the issue of energy efficiency. A substantial number of those housing groups contacted said they were either too busy or too exasperated to complete the survey. Some expressed the view that they might be "doing something wrong" by expressing their opinions, while others said they thought energy efficiency was just another hurdle that they couldn't jump over, given what they perceived was a critical lack of funds. Those who agreed to complete the survey were the more optimistic of the group, or those who had a greater than usual interest in energy efficiency or building technology.

Overall, the housing organizations mentioned barriers to the adoption of energy efficiency that include some of those mentioned in Alliance, 1989. These include the need for access to home energy rating systems or technical assistance to determine, which measures to employ, the need for energy-efficient mortgage funds or program funds to cover any additional cost of the energy measures, the need for more field research to better define affordable energy technologies, the need for more technical assistance for housing organizations to ensure proper employment of energy efficiency technologies by first-time users, the need for greater utility support for energy efficiency in affordable housing and more overall involvement of the housing industry, including real estate professionals, landlords, builders and financiers in the energy efficiency equation.

In the NCAT survey, more than 80 percent of both housing groups said they did both new construction and major rehabilitation. Nearly all said they would like to do more with energy efficiency in future projects. Barriers outlined can be boiled down to three overall categories: technical problems, financing problems and program problems.

First, on the technical side, because the housing industry is so decentralized, and governed by a different standards enforcement in each state or locality, it is difficult to simply set a national energy standard and hope that it is met through some enforcement means. Public policy leaders often assume that the technical side of the energy efficiency transition is well established, yet many housing organizations express confusion over which energy efficiency measures make the most sense to employ. This is understandable, in that climate-appropriate analysis of affordable best practice measures has not taken place for vast regions of the nation. While some work in this regard has been done for the Northwest, California and the Northeast, little research is available on various affordable state-of-the-art efficiency measures that may be appropriate for warm and humid climates, or climates found in the Midwest. In addition, the combination of indications (such as hot, wet and in a hurricane zone) represents an additional challenge when selecting efficiency measures. Virtually no research or field demonstrations have occurred to verify the combination of various energy features with different construction types in warm and humid climates. Beyond this, no certification training exists to establish a professional technical basis for the low-income energy efficiency industry, whether it be weatherization or new construction (as noted by Gerardi, 1993).

Technically, the first step is to examine current practice. In this regard, about 80 percent of the Indian housing groups said they monitored energy consumption, while only 45 percent of the other housing organizations said they collected consumption information.

Financing problems mentioned most frequently were issues of first cost and staff costs to get information and training to make the transition to efficiency. The Indian housing organizations were less likely to see additional first costs of energy efficiency as a stumbling block (29 percent), whereas 55 percent of the conventional housing organizations said "energy improvements add too much to the first cost" of housing projects. This may reflect greater experience with energy efficiency by the Indian housing developers interviewed in this survey. However, the greatest stumbling block mentioned by housing organizations was the lack of funds to support the program overall, as well as additional energy efficiency measures costs and staff time.

Program issues included problems with government program design and lack of coordination of federal housing and energy programs. A number mentioned the need for more regulatory flexibility to allow efficiency improvements. Each housing organization was asked to list three "wishes" to be fulfilled by the new leadership at the Department of Energy and the Department of Housing and Urban Development. Their responses are shown as Table 1.

The lack of coordination between federal programs dealing with energy was a priority issue for 39 percent of the housing groups surveyed. The need for more training and more program flexibility were the next most mentioned issues, while the issues of health and safety, the need for research and standards development, more emphasis on renewable and utility demand side management programs each received equal mention by housing producers.

**Need for Energy Technical Services.** Both groups of housing providers were asked to state their need for technology assistance to ease their transition to energy efficiency. Most said their needs in these areas were not being met at all under current programs. Each group was asked to rate their need as High, Moderate or Low for six areas of technical support: small grants to support trial projects, demonstration and pilot programs to provide field research and development support, training, publications and videos to address information needs, tollfree technical assistance by remote, and on-site technical assistance. The results of these questions are shown as Tables 2 and 3 below.

**Current Sources of Information and Assistance.** A wide range of energy information sources were mentioned by housing producers; clearly, housing producers are hearing many voices. Most frequently mentioned as a source of information were local utilities, equipment

Issue	Percent Unprompted Mention		
Need more program funding, more equitable funding	43 percent		
Combined housing/WX programs; federal coordination between WAP/DOE/HUD/HHS/LIHEAP/EPA	39 percent		
Need more training, more integrated training	25 percent		
Greater local flexibility needed on rules/methods	18 percent		
More emphasis on health and safety/furnace replacement	14 percent		
Need more field research, standards development	14 percent		
More involvement with utility programs and DSM	14 percent		
Need more emphasis on renewable technologies	14 percent		
Need more client education materials/programs	7 percent		

	High	Medium	Low
Small Grants	79%	14%	7%
Demos/Pilots	50%	43%	7%
Training	64%	14%	22%
Pubs/Videos	57%	43%	0%
Toll-free help	50%	43%	21%
On-site help	36%	43%	21%

Table 3. Stated Need for Technology Sup	ort Service Rated by	Non-Profit Housing Producers
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	High	Medium	Low
Small Grants	77%	15%	8%
Demos/Pilots	71%	21%	7%
Training	43%	28%	29%
Pubs/Videos	50%	43%	7%
Toll-free help	36%	57%	7%
On-site help	50%	36%	14%

vendors and local government offices. Four housing organizations relied on state energy offices, while others mentioned energy organizations in their states, such as universities or energy extension services. The heavy reliance on information from utilities may come from the fact that utilities are offering financial incentives, whereas other sources are not.

Despite the fact that the federal Department of Energy has more than 1,100 weatherization providers across the nation, some of whom are national leaders in the field of residential energy efficiency, this group of housing organizations mentioned local weatherization providers only once as a source of information and technical assistance. Thus, the national resource represented by the WAP providers currently has little connection to the housing organizations represented by this survey.

#### National Housing Organizations

The national housing organizations interviewed had various degrees of interest and support for the transition to energy efficiency. Some expressed disbelief that substantial energy efficiency could be affordably obtained, while others mentioned the social good from adding energy

efficiency-more disposable income for the low-income families occupying the housing. One energy specialist in a major housing organization noted that it was difficult to get his management to pay attention to energy. And, given the crisis in affordable housing in the last decade, most housing groups understandably have their hands full trying to secure financing and trying to overcome all the other hurdles that have stymied their work. All groups interviewed were at a loss for how to make energy efficiency a priority in their work, and they had little faith that current federal or local programs would have much impact on their projects.

The groups generally went through a series of questions about energy efficiency that conform to the following pattern. First is the question of how much efficiency is a reasonable target— 10 percent savings, 40 percent savings? When results of Canadian and Pacific Northwest field samples were explained (50 percent savings or greater) several organizations expressed disbelief. Next is the question of how to reach such a target. Is this accomplished through a single measure (a super space conditioner, say) or through a series of measures? How will any extra cost be covered? How fast is the payback?

Do the occupants have to change their lifestyles? How long will the savings persist? How do my volunteers and builders learn how to do these measures? What about new technologies?

In the end, the barriers mentioned by the national groups can be boiled down to the lack of a set energy efficiency target, lack of professional training to ensure the target is met, lack of funds to support the transition, lack of technical assistance and information to ensure the transition is smooth and effective, and finally, lack of an on-going field research and verification process to allow promising new technologies into the programs. Overall, the state of the art in energy efficiency in most low-cost housing projects is the minimum property standard.

#### Habitat Affiliates

Assured that technical assistance appropriate to their unique circumstances would be available, Habitat for Humanity International agreed to set a savings goal of 50 percent (over 1992 Habitat practice) and to begin several demonstrations toward a five-climate model that would provide proof and technical support toward the transition to affordable energy savings.<sup>4</sup> Annual savings for occupants at this savings target would range from about \$350 to as much as \$1,000 per household. Habitat has severe cost constraints—the organization strives to keep the sale price of its homes at or below \$35,000–and expressed strong interest in finding coverage for any marginal costs associated with the energy efficiency measures.

In the course of providing technical assistance to more than 100 affiliates in the last year, it was noted how all the barriers to adoption of energy efficiency come into play and how the current patchwork "system" of energy efficiency clearly doesn't work.

First, a number of affiliates said they had been approached by vendors selling energy efficiency products, but that they didn't have enough information to evaluate the claims made by vendors. Eventually, this results in an overall lack of action in energy efficiency, in that most affiliates said they would rather turn all vendors down to avoid experimenting on their partner families.

Even when high quality utility programs are available, such as the SuperGood Cents program in the Pacific Northwest, only half the affiliates in that region take part-partly because of desire to use other fuels, partly due to skepticism, or sometimes due to lack of knowledge about the program.

In another region, a utility offered subsidized technology that was far beyond the financial means of most affiliates. The technology may be appropriate for a large, upperincome home or multi-family housing, but would never ordinarily be included in a single-family low-cost home due to its large first cost (\$7,000–\$14,000). Unfortunately, the utility's offer translated to other affiliates and other regions that it cost \$7,000 or more to include energy efficiency in new construction, when, in reality, space conditioning savings of more than 50 percent can be achieved at less than \$2,000 in additional first cost. This illustrates the need to ensure that low-cost housing producers have assistance to ensure that measures are specifically engineered for low-cost housing, rather than assume that a grabbag of measures will work for all housing types.

Other affiliates reported problems with donated "high efficiency" technology. Lack of experience with the technology and lack of local inspection and training programs meant that installation was often less than satisfactory, leading to energy costs that are higher than before, sometimes even higher than mortgage payments.

Several affiliates noted that the best situation would be if an independent, credible source of energy technical assistance and support was available on the local level, a source that knew what the best measures were for this particular climate and was sensitive to the need to keep first costs low, while keeping performance high. In addition, some affiliates asked about any local training programs and whether it is possible to hire certified contractors to install some energy efficiency measures. These programs are generally only available in the few states that have state-level incentive-training programs, such as the Alaska Craftsman Home Program.

# Policy Recommendations and Program Design Strategies

Low-cost housing producers are currently underserved by federal programs that aim at improving the energy efficiency of the housing stock in general. Instead, they are served by a patchwork of utility programs, state-level rating programs and occasional local programs to encourage energy efficiency. At present, the federal Department of Energy is supporting the move toward a standardized home energy rating program that can be tied to a standardized home energy mortgage program. Major new elements needed for an effective low-cost housing program are not currently part of the program plan at Energy.

Federal support for a nationwide group of energy specialists already exists in one form through the nationwide weatherization program for low-income households. Perhaps this program could be expanded and better supported to also provide local grass-roots assistance for a new-construction program to help nonprofit and charitable housing producers. Perhaps the greatest need for federal support that cannot be met by the private sector is for high quality field research and development to better define the current "best practice" mix for measures for new construction and major rehabilitation in all climate zones. For a number of years, professionals in other arms of the energy efficiency industry, such as policy and advocacy, have assumed that the results of this type of research have been readily available, and just need to be brought together and organized. Unfortunately, much work of this type lost funding more than 15 years ago. The importance of such research cannot be overestimated. In successful programs in Canada and the Pacific Northwest, this research was critical, and laid the foundation for credible technical support through the programs' implementation.

This standards and specifications process needs to be ongoing to include new technologies and methods that may be developed. Clearly, the general building industry has not, in the absence of federal support during the last decade, found it in its interest or ability to conduct this research which is so critical to the low-cost housing producers.

A related area needing federal support is to take the standards and specifications and develop a professional skills program for energy efficiency in low-cost housing. This federal support would insure an independent, credible program of specifications and standards training and infield certification that would support the low-cost housing community, as well as the weatherization community. Certified training programs would help ensure that savings targets are met by well-trained professionals. They will bring a much-needed uniformity to the industry, allowing a massive wave of potential investment when energy efficiency is more readily accessible.

Successful programs have followed a methodology that the federal government would do well to consider. This includes: Set a savings target that is worth fighting for (10 to 25 percent savings should be replaced by 50-60 percent savings). Set a credible method to evaluate whether the target is being met, and provide field demonstration and training programs that have a solid basis in respected research and development. Provide technical assistance and support to help housing organizations meet the target, and provide support for marginal costs of efficiency (this can be handled under the current energy efficiency mortgage efforts). Make available in-field inspection and training programs that allow energy efficiency professionals to be certified in their fields of expertise. When practice has changed sufficiently to meet the savings target most of the time, change the building code to include the savings target, and set a new target for on-going programs (as the Canadian Advanced Home Program has done). For states wanting to start a program in the absence of federal support, the same formula applies.

#### Summary

Barriers to the adoption of energy efficiency by private, non-profit and charitable builders can be broken down and addressed in three broad categories: technical, financial and programmatic. Overriding barriers include the lack of a comprehensive federal program (or state-level program in all states) that sets energy efficiency targets, provides training and technical support, provides credible specifications and standards and certification training, and is based on on-going field research and development. Even housing organizations with a strong desire to incorporate energy efficiency are faced with a patchwork of state, local and utility programs that are contradictory and may not save much energy. The result is that most low-cost housing produced at present is not efficient and represents minimum property standards. The current patchwork system of energy efficiency programs can be a base of support, once organized and coordinated, to help finance and bring technical support to the long process of change to efficiency. But, in order to effectively accelerate the rate of change, these programs must be coordinated and the serious gaps in service and support must be addressed and remedied before significant savings will be realized in this housing sector.

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### Endnotes

- 1. This number is the sum of available estimates of units built annually by developers (both new construction and major rehabilitation) under the federal low-income tax credit, charitable housing groups and non-profit community development programs. Federal HOME and HOPE programs are not included in this number.
- 2. This level of savings has been reported by the R-2000 program, several major demonstration programs in the Pacific Northwest under the Bonneville Power Administration, and the SuperGood Cents utility programs, as well as a number of other field demonstration projects in various states.

- 3. These organizations included Habitat for Humanity International, the Enterprise Foundation, the Farmers Home Administration, the Housing Assistance Council, and the Low-Income Housing Coalition.
- 4. Habitat is a grass-roots organization with more than 1,000 affiliates across the nation that self-finances and builds about 10,000 units of housing a year.

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