

Management Education Practices as a Tool to Increase Energy Efficiency in Low-Income Housing

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This article investigates the correlation between energy efficient behavior(s) in low-income housing residents and low-income housing education initiatives introduced by property management in order to enhance property sustainability. A series of factors, which are likely to contribute an increase in the need for low-income housing and U.S. energy consumption are considered. The motivation (or lack thereof) of managers to participate in initiatives to educate tenants on energy efficiency is examined. The incentives for utilizing sustainable actions are explored from the perception of low-income housing residents, along with the potential benefits associated with these actions. Twenty on-site property managers for low-income properties in Colorado were surveyed about their attitudes and norms related to education of residents about energy conservation. Survey development utilized the theory of Perceived Responsibility as a foundation for question development. The results show that while property managers tend to believe that energy conservation is important, they were mixed in their level of perceived responsibility and lacked a clear understanding and plan on how to incorporate resident engagement in energy conservation.

Key Words: low-income housing, energy conservation, energy education, property management, facilities management

Introduction

In most low-income housing units, there is a lack of emphasis on energy efficiency education directed toward tenants. Those who are provided with this information usually receive it in an unorganized manner with little follow up on how behavioral change is affected by this education. Part of the reason that this information is seldom provided in a deliberate manner is attributable to the fact that there is no well-defined party responsible for conveying it. A portion of the irregularity in the delivery of this information is due to the fact that it is often delivered by various external organizations. For this information to successfully be impressed upon low-income housing residents, it needs to be delivered systematically and reinforced constantly. This lack of consistent energy efficiency education of low-income housing tenants provides excellent opportunities for the management of low-income housing units to step up and actively play a part in educating their tenants on energy conservation.

Currently, a gaping void of literature exists on the topic of low-income housing management and the impact that it can have on educating tenants about energy efficiency. The effects that property managers can have on educating tenants of low-income housing about energy efficiency are largely unknown. Even less is known about the perceptions that managers of low-income housing units have on their own abilities to influence tenant behaviors. Some managers may not believe that educating tenants is their responsibility while others embrace the idea. Other managers may perceive such efforts as a waste of time due to lack of incentive or lack of caring on the behalf of tenants. Furthermore, the incentives for low-income managers to take on the extra work of implementing energy education initiatives are unclear. The following study is meant to bring some clarification and insight to the topic of the perception of low-income housing managers in their abilities to positively affect tenant energy consumption levels through systematic education initiatives.

Background

In recent years, the available amount of low-income housing has struggled to keep up with the number of people who require it. There are two current major factors that are likely contributing to - and will continue to contribute to - a need for higher numbers of low income housing in the near future. First, in the U.S. the baby boomer generation is now starting to retire. In 2010, there were an estimated 40.3 million U.S. citizens over the age of 65 and by the year 2030 this number is expected to increase to 72 million citizens in this age bracket (Department of Health & Human Services, 2011). Of the 40.3 million U.S. citizens over the age of 65 in 2010, approximately 3.5 million (or about 9%) were below the poverty line (Department of Health & Human Services, 2011). If the percentage of elderly that are below the poverty line remains constant, this will mean that by 2030, 6.3 million elderly will fall below the poverty line. The impending increase in the number of elderly citizens that fall below the poverty line will result in an increased demand for low-income housing. Second, recent economic instabilities have caused the poverty rates to increase in the U.S. Over a five-year span of time the poverty rate rose 2.7%, from 12.3% in 2006 to 15% in 2011 (DeNavas-Walt, Proctor, & Smith, 2012). If the poverty rate continues to rise the need for low-income housing will likely shadow this trend. An increasing number of retirees, especially those who fall below the poverty line, will create a need for the construction of new low-income housing units, which will present an opportunity to build them efficiently from the start.

In the U.S., national energy consumption levels have grown considerably over the years. It is estimated that between 1980 and 2005 house hold site energy usage increased by 12.4% or 1.2 quadrillion BTUs (quad) (Hojjati & Wade, 2012). Although new technologies, materials, construction methods, and higher efficiency appliances are making it easier for households to use less energy, national energy usage is still on the rise. With the exception of a few brief lulls, energy consumption in the U.S. has been steadily rising since the 1950s (U.S. Energy Information Administration, 2011). Increasing energy usage trends hinge on two main factors: Recent generations' inseparable relationship with electronic devices as well as a steadily increasing population size, which will continue to push U.S. energy demands upwards (U.S. Department of Commerce, 2008). Since the population size in the U.S. is projected to continue growing (U.S. Department of Commerce, 2008) coupled with fact that Americans are becoming more dependent on electronics, it is reasonable to believe that these trends will continue and that the U.S. energy consumption rates will continue to rise without drastic "sustainable" measures to help curb this trend.

Increased energy consumption rates will raise energy prices unless production is raised to match demand. Many lower income citizens/ families can hardly afford their utility bills and are already very sensitive to fluctuations of their utilities prices. In the U.S. 67% of all low income housing residents are classified as "extremely low income (Langevin, Gurian, & Wen, 2011)." This startling fact suggests for these "extremely low income" residents, it is necessary to spend what little money they do have wisely. Many of these low-income residents living in affordable housing rely on government subsidies or charitable donations from outreach organizations as a supplement to their rent and utility bill payments.

In 2008, the U.S. Department of Housing and Urban Development (HUD) provided operating subsidies in the area of five billion dollars (of taxpayer money) on energy in its assisted housing units (Langevin, Gurian, & Wen, 2011). Subsidies such as these help to lessen some of the financial pressures that utility costs put on low-income housing tenants. Similarly, the American Recovery and Reinvestment Act of 2009 (Recovery Act) released approximately 249.1 billion dollars to be used for multiple purposes on the state and local levels of government (United States Government Accountability Office, 2012). Of this investment, HUD released four billion dollars to various Public Housing Authorities (PHAs) to finance public housing capital funds and congress released funds to various Housing Finance Agencies (HFAs) to restart stalled projects (Government Accountability Office, 2012). These funds allowed thousands of low income housing units across the country to be renovated and upgraded. A portion of these funds contributed to energy efficient renovations in some of these low-income housing units.

Assuming that the number of U.S. citizens in need of low-income housing continues to increase along with upward trending energy usage patterns, there will be an intrinsic need to conserve energy in low-income housing units. Successful energy conservation tactics will include attacking the issue on two fronts: Upgrading the physical attributes of the housing units so that they require less energy to run and influencing tenants to develop energy conserving habits. Proper weatherization of housing units coupled with the use of high-efficiency appliances can help save considerable amounts of energy. Upgrading housing units will still fall short of achieving maximum energy efficiency unless these upgrades are used in a resourceful manner. Improving the energy efficiency of the

low-income public housing stock will provide far reaching economic benefits. These energy savings will lessen financial stresses for: low-income households, the public housing authority, and ultimately the tax paying public by reducing the amount of energy costs that the government has to subsidize (Barker, 2012). Funds saved by housing authorities on reduced utility costs may be applied towards other maintenance and improvements of the low-income housing units. The use of additional funds for improvements of low-income housing units has the potential to increase the standard of living for the buildings tenants.

Energy efficient upgrades and remodels are not the only factors that impact energy efficiency. A large portion of energy usage tends to be related to the habits of the occupants. Previous studies have estimated behavioral factors are accountable for about 30% of the variance for overall heating consumption, for about 50% for overall cooling consumption and that a savings of 10-20% can be achieved just by simple behavior adjustments (Langevin, Gurian, & Wen, 2011). For this reason, tenants must be educated on proper use of these new, more energy efficient systems as well as how their behaviors affect energy usage. Further complicating the matter of influencing low-income housing tenant energy conservation behaviors is the incentive (or lack there of) for these tenants to take heed to these energy conservation tactics. In most low-income housing units the burden of utility bills are distributed in one (or a combination of two) of three ways: the renter may be responsible for their own utility bills, their bills may be included in rent, or the government may partially or wholly subsidize the renter's bills. In 2009, out of the approximately 21.2 million rental housing units that used piped gas, about 5.6 million units had their gas covered in either rent, other fee(s) or obtained it free (U.S. Department of Housing & Urban Development & U.S. Department of Commerce, 2011). Similarly, out of the nearly 35.4 million rental housing units that used electricity, approximately 5 million of those had electricity covered in either rent, other fee(s) or obtained it free (U.S. Department of Housing & Urban Development & U.S. Department of Commerce, 2011). In these cases where tenant utility costs are included in rent or government subsidies pay for them, there is little incentive to change energy usage behaviors. Since low-income housing subsidies are funded from taxes, taxpaying citizens of U.S. are actually the ones who have something to gain the "greening" of low-income housing units in this country (Barker, 2012).

In addition to the split-incentive problem, there are a couple of perceptions that are often held by tenants that may prevent them from adapting to energy efficient actions. One potential disconnect from the tenants' perception and energy usage (especially those who aren't responsible for their own utility bills) is that they are less able to see the benefits associated with using less energy. Another potential for lost energy saving is that tenants may be unwilling to compromise or change actions that they perceive may negatively affect their comfort levels. A study performed on the energy consumption behaviors for 50 residents residing in low-income housing units in Philadelphia provided some insight of how these tenants perceived and interacted with their interior environment. In multiple cases, some tenants expressed frustration with inability to control their interior environment, which was most often associated with either missing, obstructed, broken, or entirely absent radiator knobs (Langevin, Gurian, & Wen, 2011). In another case, because one tenant had an energy efficient air conditioner, they would turn it on higher than normal when leaving the house, stating "When I'm out I turn it [the air conditioner] on so it can be cool when I come in." This tenant was an ideal example of "rebound effect," using a device more often because of its greater energy efficiency while still maintaining the perception of using less energy (Langevin, Gurian, & Wen, 2011). Other times the slow response times of heating and cooling systems may cause a tenant to take drastic corrective action to remediate their comfort levels instead of planning ahead to create comfortable situations without as much energy waste. Opening a window (or worse, turning on an AC unit) in the winter to cool off a house that has overheated instead of keeping the thermostat at a more mild temperature from the beginning may constitute an overcompensating action that is wasteful.

In order for maximum savings and energy efficiency to occur in low-income housing units, a combination of energy efficient remodels, energy savings education and some form of accountability must be established. Better quality low-income homes and appliances will improve occupant health and lower energy usage needs. A better-educated population will have the tools and knowledge to make better energy consumption decisions that will help them to achieve higher indoor environmental quality and comfort using lower levels of energy. Lastly, if energy consumption is not perceived to have any positive impact on those tenants who do not pay for their own utilities, it is imperative that they know the connection between management paying less for utilities may equal more money for property maintenance.

Methodology

For this study, a survey was developed to assess the level of commitment and knowledge of on-site management for low-income multifamily housing related to energy conservation. Questions included in the survey development were based on individuals' "awareness of consequences", "ascription of responsibility" and their attitude and norm related to energy conservation (Table 1). "Awareness of consequences" (AOC) was measured by two survey items: (1) Energy conservation decreases utility consumption and (2) Energy conservation is good for the environment. "Ascription of responsibility" (AOR) was also measured with two survey items: (1) I feel a personal obligation to educate residents about energy conservation and (2) I feel a personal obligation to conserve energy myself. Respondents' attitude and norm related to energy conservation was measured with one survey item: Energy conservation is good for the environment (*attitude*) and Apartment complexes have a responsibility to educate tenants about energy conservation (*norm*). For each question, respondents were asked to indicate their level of agreement with these statements using a 7 point scale where 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree and 7 = strongly agree. Additional survey questions asked about approaches used by management to educate residents about energy conservation.

Surveys were administered on-site to management staff involved in the daily management and maintenance of properties included in this study. Although respondents were asked to work through the survey individually, a member of the research team was present to respond to and clarify questions about the survey items. A total of 20 surveys were completed at 8 different low-income housing complexes. Properties were identified for inclusion in this study based on their participation in Energy Outreach Colorado's Multifamily Weatherization Program. As participants in this program, these properties had received funding for weatherization upgrades intended to reduce energy consumption. All of the individuals responding to the survey were either aware of the Energy Outreach Colorado program and/or had participated in developing the funding proposal that was submitted to Energy Outreach Colorado.

Results

With respect to the norm question, the mean response was 4.68 or just approaching *slightly agree* (Table 1). Twelve respondents agreed that apartment complexes have a responsibility to educate tenants about energy conservation. Five, or 25%, of the respondents disagreed at some level with this statement. Two of these strongly disagreed. This indicates that the majority hold a norm that managers of low-income multifamily housing should be active in educating residents about ways to conserve energy conservation. However, one-fourth did not hold this norm, indicating that they do not believe this is an appropriate responsibility of property managers.

When asked about their attitude related to energy conservation, 14, or almost 75%, had strong positive attitudes related to energy conservation (Table 1). The mean of all responses was 5.80 or moderately agrees. The majority of respondents either moderately agreed (n = 2) or strongly agreed (n = 14) with the attitude statement that energy conservation is good for the environment. The remainder either slightly disagreed (n = 1) or strongly disagreed (n = 3) with this attitude statement. This indicates that the majority of respondents hold positive attitudes related to energy conservation; however, a few respondents have negative attitudes related to energy conservation.

There were two survey questions that addressed ascription of consequences (AOC1 and AOC2) (Table 1). AOC1 identified decreases in utility consumption as a positive consequence of energy conservation. Three-fourths of respondents either moderately agreed (n = 5) or strongly agreed (n = 10) with this statement. The mean of all responses for AOC1 was 5.50, or slightly to moderately agree. AOC2 identified the importance of energy conservation for future generations as another positive consequence of energy conservation. The mean response for AOC2 was approaching moderately agree or 5.80 and was slightly stronger than the mean response for AOC1. In both questions, however, 4 respondents indicated that they either slightly disagreed (n=1) or strongly disagreed (n=3) with these statements of positive consequences related to energy conservation. Overall, these responses indicate a high level of understanding of the positive consequences of energy conservation. However, it is interesting that a few respondents did not acknowledge these positive benefits.

The last two questions on the survey being reviewed in this paper addressed each individual's personal ascription of responsibility related to energy conservation (AOR1 and AOR2). AOR1 addressed respondents' perceived personal level of responsibility related to educating residents about energy conservation. The mean response for this question was fairly neutral at 4.70. Just over half ($n = 12$) of the 20 responses were in the agree range. Of these, two indicated they only slightly agreed with this response, six indicated that they moderately agreed and only four strongly agreed. Of the remaining eight responses, one was neutral, four slightly disagreed, one moderately disagreed and two strongly disagreed. This indicates that respondents were tending toward a split in their level of perceived personal responsibility for education of residents about energy conservation. For AOR2, the mean response of 5.70 was significantly higher than for AOR1 and was approaching moderately agree. Additionally, only four respondents disagreed with this statement. Two moderately disagreed and two strongly disagreed. This indicates that respondents tend to have a higher level of perceived responsibility related to their own energy conservation behaviors compared to educating residents about energy conservation.

Table 1
Mean, Median, and Mode for responses to survey question.

Survey Question	Mean	Median	Mode
Apartment complexes have a responsibility to educate tenants about energy conservation. (Norm)	4.68	5.00	6
Energy Conservation is good for the environment. (Attitude)	5.80	7.00	7
Energy Conservation decreases utility consumption. (AOC1)	5.50	6.50	7
Energy conservation is important for future generations. (AOC2)	5.80	7.00	7
I feel a personal obligation to educate residents about energy conservation. (AOR1)	4.70	5.50	6
I feel a personal obligation to conserve energy myself. (AOR2)	5.70	7.00	7

1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree and 7 = strongly agree

AOC: Ascription of consequences

AOR: Ascription of responsibility

When asked about training on energy conservation, two-thirds of the respondents indicated that they do not provide this type of training routinely to residents. When asked what methods are used to educate residents, the majority indicated the use of flyers. Only one respondent indicated that a formal process existed to routinely train and reinforce the importance of energy conservation with the residents.

Conclusions and Recommendations

The preeminent goal of this research was to enhance the overall sustainability and energy efficiency of homes by gathering the information and methods necessary to build a formwork for its future use. Overall, there was a strong trend of agreement with all of the survey items. This was expected since all of these properties had participated in the Energy Outreach Colorado's Multifamily Weatherization Program. However, Over half ($n = 5$) of the respondents disagreed with the statement that "apartment complexes have a responsibility to educate tenants about energy conservation" and only 2 strongly agreed with this statement. In addition, because of the population used in this study, it was expected to all responses would be agree or higher. It was presumed that because these individuals were managing properties that had applied and received funding for the purpose of increasing the energy efficiency of their buildings, that they would at the very least all have positive attitudes and norms related to energy conservation and that they would have strong agreement with the ascription of consequences and responsibility statements. This was not the case across the board. Although these results are not generalizable, they do indicate the presence of a disconnect between property managers of low-income housing on the importance of educating residents about energy conservation and the broader need for energy conservation in low-income properties. Based on these results, additional research is needed to identify best practices for educating residents of low-income housing projects about the importance of and the need for energy conservation. Opportunities for additional research also exist for examining the effectiveness of management led educational initiatives for tenants. There are two areas of research that should be included in future research related to this area. These include (1) the relationship between tenants' economic status in relation to their level of energy conservation and (2) the current state of the physical properties.

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