# Taking the LEED:

**Exploring environmental behaviors and identities of residents of green multifamily housing**

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**ABSTRACT**

This study explores the intersection of three previously separate research topics — the relationships between environmental knowledge, identity, and behavior; the influence of economic status on environmentalism; and the benefits of green multifamily housing. The interaction between these concepts is important because of current trends in both the market-rate and affordable housing sectors toward sustainable building practices, and little is known about whether environmentalists seek out green housing and/or if green housing increases residents' environmentalism. Through a survey of 120 residents of green-certified multifamily housing in the Boston area, this study found residents show similar relationships between environmental knowledge, identity, and behavior as previously studied general populations, and that income is positively correlated with environmental identity but not behavior. As for housing, residents are not extremely knowledgeable of but still identify with the green features of their buildings, especially residents of market-rate buildings. Such features are not the most prevalent factor in residents' decision to live in their current apartment, though. These findings suggest that the continued market-driven and government incentivized trends in green building are beneficial as a way of making sustainability the status quo for housing and indirectly encouraging environmental behavior for all.

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## INTRODUCTION

On August 27, 2013, a small crowd gathered on a street corner in Roxbury, MA for the ribbon cutting of a new row house (Urbanica 2013). In a neighborhood of old, classic New England triple deckers, these four three-bedroom units stood out from the other houses with their slightly blockier shape and fresh coat of paint. This building is also different in a less visible way: Each home can be heated with about the same amount of energy it takes to run a hair dryer.

"We are here to celebrate … the next generation of housing construction," Sheila Dillon, the director of the Boston Department of Neighborhood Development, said to the assembled crowd (NERCC 2013). The small multifamily building in Roxbury is the first completed project of Boston's E+ Green Building Demonstration Program, an initiative announced in 2011 to create homes that are energy positive, meaning the buildings use less energy than they create over the course of a year. Features such as triple-paned windows and a floor plan designed for optimizing passive ventilation means the residents of these homes need to turn on the heat for only two or three weeks during the coldest part of the winter, a drastic reduction from the multiple months of heating most New England homes require. Excess energy produced by solar panels on the roof feeds into the city's grid. Although labeled as an energy program, the sustainable features of the building extend beyond energy reduction, with water-efficient appliances and plumbing and a rainwater harvesting system for irrigating the native and drought-resistant plants in the yard ("232 Highland Street," 2014).

In the eight years since the E+ program began, three projects have been completed and three more are currently in the planning and design process. In addition to these six sites, the city has enacted multiple incentives and regulations to address sustainability in new construction and

renovation of all building types, and market demand has also increasingly promoted green buildings.

Despite an increased focus on sustainability at an institutional level through programs such as E+, American culture often places the blame and responsibility to address environmental issues on individuals rather than organizations. Such a focus on individualism creates a culture that links individual pro-environmental behavior very strongly to one's individual identity (Carfagna et al. 2014). This approach also narrows our view of what range of pro-environmental behaviors are available for us to take, leading us toward individual actions like recycling plastic containers rather than motivation to change the system of consumer habits that produces so many plastic containers to begin with. Such individual actions may make people feel environmentally conscious but have limited global impact (Maniates 2001).

Many of our behaviors, however, straddle this line between individual and collective, since our personal actions are heavily influenced by the institutions of which we are a part. Housing, especially for those who live in apartment buildings, is one such example. The Boston Chief of Environmental and Energy Services, Brian Swett, alluded to the agency of the individual within city sustainability efforts in a video celebrating the E+ homes. "When you think about the environmental impact of these residents, it is tremendously reduced," he said. "They can take mass transit, their houses produce more energy than they need, they're extremely water efficient, this is the new way of sustainable living in a city," (NERCC 2013).

Who are the individuals living this green lifestyle in a green house? Does living in green housing turn residents into environmentalists? Or do environmentalists seek out green housing? Research over the last 40 years has worked to answer questions such as these, exploring the relationships between environmental attitudes, values, identities, behaviors, and beliefs. Most of

this work has been survey research, finding correlations and predictions of what leads to pro-environmental behavior (PEB). Previous research has shown that having environmental knowledge is somewhat predictive of future pro-environmental behaviors, and that pro-environmental identity is strongly predictive of pro-environmental behaviors. However, almost all this research has been conducted on general populations and has not explore the impact of other types of identity on PEB, such as race, class, or gender. Most prior studies have also only studied the link between identity/knowledge and behavior in a single direction (predicting behavior), rather than as an iterative process in which behavior may reinforce environmental knowledge/identity; the reinforcement idea is only beginning to be tested.

My research for this project is informed by these models and studies of identity and behavior, but it expands on them in two ways. First, I apply these general concepts of environmental orientation to the specific case of green multifamily housing. Second, since I have surveyed residents who have already made the behavioral decision of living in green housing, my exploration of the relationships between PEB, environmental knowledge, and environmental identity is iterative rather than predictive.

My focus on green multifamily housing stems from current trends in both market-rate and affordable housing development to build sustainably. There are myriad reasons for this trend, from pure interest in environmentalism to capitalizing on economic benefits. In research and in conversations I have had with property managers and Boston housing and planning officials, it is the economic benefits that differentiate affordable and market-rate housing developments. While they may be achieving the same level and label of sustainability, their motivations differ. An overarching theme in the market-rate sector is the ability to charge residents more for the “green” label, while the affordable housing sector is spurred by an interest

in reducing energy costs. I am interested in seeing whether these development trends are reflected in the residents' perspectives of their homes.

Understanding the multifamily housing sector is especially important because it is a prime example of the balance between individual and institutional environmentalism. Although residents may choose their own apartments, they most likely did not also develop the property itself. According to the 2017 American Community Survey, 35% of households in Boston rent which is the same as the national average (U.S. Census Bureau 2017). These rates are expected to grow rapidly in the coming years (Hopkins, Read, and Goss 2017).

My research is guided by the question: *What are residents' experiences with green multifamily housing, and how are those experiences related to pro-environmental identity and economic status?* Framing my research with this question allows me to view the factors of identity, behavior, knowledge, and housing choice as potentially related but not necessarily causal factors. To answer this question, I surveyed residents of green multifamily housing in the Greater Boston Area.

## LITERATURE REVIEW

### Pro-Environmental Behavior

The question of defining pro-environmental behavior (PEB) is itself a field of study, in which numerous labels and categories of behaviors have been proposed. One such definition is that a PEB "consciously seeks to minimize the negative impact of one's actions on the natural and built world" (Kollmuss and Agyeman 2002:240). Stern (2000) presented an opposing idea, defining PEB by impact rather than intent to behave in a manner that is good for the environment. This is important because it is certainly possible to behave in ways that are beneficial for the environment without being conscious of one's positive (or at least not-negative) environmental impact.

Stern sorted environmental activities into five categories: activist, non-activist, public-sphere, private-sphere, and other behaviors. Other work has further delineated private-sphere behaviors (actions taken around the home) into weatherization, energy-efficient equipment, maintenance, adjustments, and daily actions (Dietz et al. 2009), while a different line of research has categorized behaviors by the resources they consume: water/energy use, waste, transportation, and shopping (Whitmarsh and O'Neill 2010). Yet another method differentiated between reduction and efficiency behaviors (Gillis 2016). A meta-analysis of 49 PEB studies found 42 unique methods of measuring individuals' total PEB, with wide variation and inconsistencies between the scales used (Markle 2013). Based on these existing measures, Markle created a conglomerated scale of 38 items categorized as either conservation, environmental citizenship, food, or transportation behaviors.

Although there is limited consensus on how to define or measure PEB, there is agreement that these behaviors are predictable and influenced by both internal factors (e.g., attitudes,

values, norms, motivations) and external factors (e.g., cultural, geographic, and economic influences). Scholarly work on the relationship between these factors began in the late 1970s with a focus on environmental attitudes (Dunlap and Liere 1978) with the widely used New Ecological Paradigm (NEP) scale. In the years since, scholars have become more nuanced in defining and modeling the differences and interactions between these aspects of environmental orientation.

Much of the work on modeling environmental behavior has adopted Ajzen's (1991) Theory of Planned Behavior, which addresses behaviors of all types, and applied it specifically to environmentalism. The theory states that attitudes, norms, and perceived behavioral control influence each other and lead to behavioral intention, which then predicts behavior. Dunlap and Liere's NEP scale has therefore been extremely useful for measuring how environmental attitudes influence behavior, and have found mixed results (e.g., Dunlap and Liere 1978; Stets and Biga 2003).

In a theoretical paper, Kollmuss and Agyeman (2002) explored 20 years of models of pro-environmental behavior and then presented their own. These models began with linear progressions from knowledge to attitude to behavior and became increasingly complex as researchers outline a "knowledge-behavior gap," recognizing that just because people have knowledge of environmental problems does not mean that they will act on these issues. Kollmuss and Agyeman based their own model on decades of prior research, highlighting the importance of knowledge, emotional involvement, and external factors such as infrastructure, economics, and political/social/cultural factors as motivators to bridge the knowledge-behavior gap. They suggested that the gap itself is caused by a lack of incentives and positive feedback, both internal and external, for partaking in pro-environmental behavior.

Questions of environmental behavior have been asked by a range of social scientists, from economists interested in consumer behaviors (Frederiks, Stenner, and Hobman 2015) to psychologists focused on internal attitudes and values (Dunlap and Liere 1978; Stern, Paul C. 2000). As Kollmuss and Agyeman conclude, none of the models presented so far are wrong, per se; however, no one has yet created a full model that accounts for every possible factor. In fact, it may be impossible to do so (Kollmuss and Agyeman 2002:256). Instead, the current models are useful in showing that various factors are related and a study of PEB must consider at least some of a broad range of influences. Taking a sociological perspective of contextualizing individuals in their social and physical surroundings, my research examines the relationships between environmental knowledge, environmental identity, pro-environmental behavior, and external factors.

**Environmental Knowledge**

Environmental knowledge is a starting place in many of the existing models of environmental behavior, viewed as a prerequisite to PEB but not powerful enough by itself to spur action (Frick, Kaiser, and Wilson 2004; Kollmuss and Agyeman 2002; Robelia and Murphy 2012). For example, through surveying about 1,000 students at an Israeli university on their environmental knowledge, environmental emotions (concern for, commitment to, and connectedness to nature), and environmental behaviors, Carmi, Arnon, and Orion (2015) found knowledge was not a significant enough factor on its own to influence environmental behavior. When accounting for the environmental emotions variable, though, there was a large effect on PEB.

In perhaps the broadest sense, knowledge can be divided into the subcategories of subjective and objective knowledge. Objective knowledge describes knowing facts and

procedures, while subjective knowledge refers to perceiving and understanding information (Carmi et al. 2015; Ellen 1994). Environmental knowledge is studied objectively by asking questions such as the length of time it takes plastic to decompose in nature or the ecological benefits of wetlands. Subjective knowledge is measured through asking questions such as if respondents feel they understand the reason for an environmental problem and feel they can solve it.

Environmental knowledge can also be divided into subcategories based on what environmental theme is discussed, with topics such as local plant species, energy production, and water pollution. A lot of environmental knowledge research, though, has focused specifically on climate change. Overall, there has been an upward trend in the percentage of Americans who think global warming is happening, is human-caused, and is actively and negatively impacting Americans' lives (Leiserowitz et al. 2018). However, Kahan (2015) argued that knowledge of climate change is often measured subjectively while researchers attempt to measure it objectively, surveying participants using questions that ask about beliefs or perception of risks rather than environmental facts. It is important to make such a distinction especially since climate change has become a partisan issue in the United States, with more Democrats than Republicans believing in climate change and worrying about its effects on their lives (Dunlap, McCright, and Yarosh 2016; Van Boven, Ehret, and Sherman 2018). Asking questions about beliefs, worries, or risks related to climate change may be less a measure of objective environmental knowledge and more a measure of partisan identity. This partisan difference is mitigated, however, when asking solely about environmental facts rather than phrasing the questions to consider personal understanding of risk and impacts: In a 2015 survey that removed

references to individuals' beliefs and instead began questions with "climate scientists believe," Kahan found liberals and conservatives responded similarly.

**Environmental Identity**

Much of the defining work of internal factors influencing PEB — such as attitudes, values, beliefs — is situated within psychology more so than sociology. The difference between these two social sciences comes across in the vocabulary and scope of their research: psychology focuses on studying attitudes toward the environment, limiting the researcher to understanding how individuals make their own choices. Studying environmental identity, however, contextualizes those choices within social structures and a hierarchy of other identities.

Environmental identity is defined as "one part of the way in which people form their self-concept: a sense of connection to some part of the nonhuman natural environment, based on history, emotional attachment, and/or similarity, that affects the way in which we perceive and act toward the world; a belief that the environment is important to us and an important part of who we are" (Clayton 2003:45-46). As part of the same definition, Clayton also established that environmental identity can serve as a collective identity, one that both influences and is influenced by social factors. Clayton developed and verified an Environmental Identity Scale, a Likert scale of 24 questions, to "examine whether individual differences in environmental identity can predict behavior" (Clayton 2003:52).

Although collective factors play a role in understanding individual identity, Clayton is a psychologist and remains focused on the agency of individuals. Stets and Biga (2003) spoke to the difference between psychology and sociology and provided a theoretical outline for understanding the connections between environmental identities, attitudes, and behaviors contextualized by social aspects of identity. To test their proposal, Stets and Biga used a series of

questionnaires to survey 437 college students at a large northwestern university about their environmental behaviors, identities (including their prominence and salience), and attitudes. The analysis of these surveys shows that one's "identity and its prominence, commitment, and salience significantly influence pro-environmental behavior" (Stets and Biga 2003:417). Although attitudes (such as an "ecological worldview" and "awareness of consequences") are somewhat associated with pro-environmental behaviors, there is a much stronger link when also accounting for identity. The researchers were also interested in how environmental identity correlates with gender identity. They found associations between femininity and ecological worldviews, masculinity and environmental-identity salience, but no link between gender identity and pro-environmental behaviors.

***Redefining "environmental"***

Although recent research on attitudes, knowledge, behavior, and external social and economic factors has covered a range of environmental topics, most research on environmental identity has remained rooted in Clayton's scale, which focuses specifically on identifying with nature. This scale asks respondents to rank their agreement with statements such as "I spend a lot of time in natural settings" and "I think of myself as part of nature, not separate from it" (Clayton 2003:52), and does not include other environmental concepts such as energy use or pollution. Whitmarsh and O'Neill (2010) broaden the definition and measurement of environmental identity by developing a 'pro-environmental self-identity scale' with four items on a 5-point agreement scale: "'I think of myself as an environmentally-friendly consumer,' 'I think of myself as someone who is very concerned with environmental issues,' 'I would be embarrassed to be seen as having an environmentally-friendly lifestyle' (scoring reversed), and 'I would not want my family or friends to think of me as someone who is concerned about environmental issues'

(scoring reversed)" (Whitmarsh and O'Neill 2010). The authors distributed this scale to households across the United Kingdom as part of an eight-page survey that also measured environmental knowledge, attitudes, values, and behaviors. This questionnaire addressed both environmental identity and environmental behavior as broad concepts in addition to targeting specific identities (e.g., taking pride in being someone who buys carbon offsets) and behavior categories (e.g., buying carbon offsets). As expected, they found both self-identity and past behavior were strongly correlated with predicting pro-environmental behavior. The correlation was stronger for the specific identity and behavior of carbon offsetting than the general relationship between PEB and pro-environmental self-identity.

Other studies of environmental identity have found it to create a reinforcing loop with environmental behavior, known as a positive spillover effect. A meta-analysis of spillover literature (Nilsson, Bergquist, and Schultz 2017) found spillover can occur behaviorally (e.g., buying eco-labeled products and turning off lights), temporally (e.g., decreasing water use rates over time), or contextually (e.g., recycling programs in the workplace promoting employees to recycle at home). There is also evidence, however, of negative spillover effects, in which individuals feel licensed to behave in morally negative ways to the environment directly following engagement with PEB (Mazar and Zhong 2010). Negative spillovers usually occur when an initial PEB is driven by a need to reduce a negative affect, such as guilt or fear. Completing a single environmental action allows the individual to feel as if they have done their duty and are now justified in not taking further action (Truelove et al. 2014).

The difference between positive and negative spillover is the association of the initial PEB with one's values and identity. When the first action becomes a way for individuals to display to the world their environmentalism and demonstrate consistency in their behaviors, the

likelihood they will continue to engage in PEBs increases. In each of the positive spillover examples listed above, the initial PEB reinforced the salience of participants' environmental identities, which encouraged further action (Nilsson et al. 2017; Whitmarsh and O'Neill 2010).

## External Factors and Environmentalism

### *Socioeconomic status*

As Stets and Biga (2003) remind their reader, identity is hierarchical, and every individual is constantly balancing and ordering a variety of prominent identities that are interrelated. While economic status is a different type of identity than environmental identity, the two often overlap. In a society that so highly values individualism as a method to address environmental problems (Maniates 2001), consumer behaviors are directly related to models of identity and behavior. For example, Carfagna et al. (2014) bring Bourdieu's habitus theory to environmental sociology through qualitative interview research on high cultural capital (HCC) ethical consumers. Through survey and interview research, they conclude that an eco-habitus has emerged for HCC consumers, flipping Bourdieu's original model. Much like his initial characterization of low cultural capital consumers, today's HCC ethical consumers value the local, material, and manual over worldly, ideal, and mental consumer goods because of a social desirability to consider the cosmopolitan, global impacts of consumerism. This same study also found ethical consumers to be "more female, Whiter, richer, and much more educated than the general population." (Carfagna et al. 2014:163).

The relationship between PEB and socioeconomic status has been further explained through Costly Signaling Theory, which states that an altruistic act (such as making an expensive, environmentally friendly purchase) is a way to communicate that an individual has an excess of time, energy, money, or other valuables and is willing to sacrifice their resources for

the sake of others. In return, the consumer gains prosocial status, the ability to show that they care about the world (Griskevicius, Tybur, and Van den Bergh 2010:394). In simulation experiments, when choosing between an environmentally friendly dishwasher, car, or backpack and a conventional alternative, participants chose the green version after being primed to consider status, public (rather than private) settings, and price (Griskevicius et al. 2010). This research suggests that consumers may not always be motivated by knowledge or concern to behave in environmentally friendly ways but are aware enough of environmental concerns to see that displaying their green purchases increases their prosocial status.

One widely studied example of environmental costly signaling is the Toyota Prius. This car, which accounted for 51 percent of hybrid electric vehicle sales in 2007 and 2010 (Budinsky and Bryant 2013:219), is marketed as an environmentally friendly consumer decision. Maynard (2007) found that Prius sales outnumber other hybrid electric vehicle sales because the Prius is only made as a hybrid, whereas other cars have both hybrid and conventional versions. This means all Priuses (and by extension, their owners) are immediately associated with environmental benefits. Driving a Prius serves as a very visible and costly symbol of caring for the environment, a way for drivers to show that they have dedicated their money toward an eco-conscious life. This elevates the consumer's prosocial status. In addition, the U.S. government was involved with Prius sales through a series of tax incentives. Most of these credits expired in 2006, but sales continued to increase even without the tax benefits, perhaps due to the increase in prosocial status that is achieved by buying a Prius (Griskevicius, 2012:398).

In the aforementioned examples of Costly Signaling Theory, the costlier option was also the most environmentally beneficial option. In some cases, however, the most environmentally friendly option is also the least expensive, and consumers are therefore less motivated to choose

that option. For example, riding a bus conserves much more energy than driving the most environmentally friendly car but, although driving a hybrid car raises one's social status, taking public transportation lowers status because it is a less expensive option (Sadalla and Krull 1995).

Such a discrepancy raises questions about the difference between impact and intent when measuring PEB. Through interview research with 1,012 residents in Germany, Moser and Kleinhückelkotten (2018) found that environmental identity was strongly correlated with income and a strong predictor of PEB overall, but that those with high environmental identities used more energy and had slightly larger carbon footprints than those with a self-reported lower identity. The researchers therefore suggest "individuals' genuinely felt pro-environmental stance is overridden by the overall effect of various consumption options that open up with higher socioeconomic status" (Moser and Kleinhückelkotten 2018:647).

The link between socioeconomic status and environmental identity is also impacted by environmental knowledge. Zabkar and Hosta's (2013) research on the relationship between concern, information about environmental impact, willingness to act, and prosocial status in making environmentally conscious consumer decisions is one specific example: through survey research on consumers in Central European cities, Zabkar and Hosta found that knowledge is enough to convince only concerned consumers to partake in pro-environmental consumer behaviors. For those with less concern for the environment, however, environmental knowledge needed to be paired with the possibility of being given a higher social status (as described by Costly Signaling Theory) in order to successfully motivate pro-environmental consumer behavior.

### *Health factors*

Another important factor influencing participation in PEB is the impact of the action on one's personal health. Overall, people behave in ways that preserve their own health, perhaps to the detriment of others. Szasz (2007) calls this phenomenon "inverted quarantine," in contrast to quarantining someone who is sick.

Inverted quarantine has been practiced for centuries, most notably through the creation of walled cities, which allowed a small community to stay protected from the rest of the world. This idea can be applied to environmental consumerism: since today's consumers cannot put up physical walls to protect themselves from environmental hazards, they act by buying protective products such as organic food and water filters. These "safer" products are usually more expensive, once again tying environmental behavior to economic status.

The impacts of inverted quarantine are twofold. First, Szasz argues that this self-centered focus on environmentally safe products extends beyond the world of consumerism and into the political realm, labelled political anesthesia (Szasz, 2007:195). Those who have quarantined themselves are no longer threatened and do not feel vulnerable to negative environmental impacts, and therefore do not get involved with solving problems on a grander scale, such as voting for environmental protection laws. This is similar to the idea of a negative spillover effect, that individuals feel licensed by their participation in one environmental action to not participate in further PEBs.

Secondly, just because a product is seen as a way to quarantine oneself does not necessarily mean it is actually beneficial for the environment or the consumer. In the case of bottled water, for example, the entire process of making and selling the water is detrimental to the environment, and the final product is not even guaranteed to be safer than tap water (Szasz,

2007:174). On the other hand, organic food is a more environmentally friendly and healthier alternative to conventional food. While some consumers may buy it for the purpose of personal protection, their behaviors are positive for everyone and everything involved in the food system.

The organic food movement is not without controversy, though. When Wal-Mart began selling organic food in the early 2000s, many in the environmental community disapproved. Brisman (2009) argues that the disapproval came from a worry that the status associated with the buying organic food, that of wealth and care for the environment, would be weakened if everyone were able to buy Wal-Mart's organic food at low prices. The organic food movement, as with other forms of inverted quarantine, has become not just about protecting one's health, but about projecting one's wealth and environmental interests as well.

## Green Building

### *An Introduction*

Based on the general models of why individuals may or may not adopt pro-environmental behaviors, I will now turn to the specific example of the behavior of living in a green building. Once again, this is interesting because living in green housing is an individual action impacted by a history of developers and property managers who made choices that influence residents' ability to behave sustainably. While there are a variety of definitions of "green buildings," they generally address four key concepts: they minimize impacts on the environment, enhance the health of occupants, encourage economic development and a return on investment for developers and the community, and include lifecycle assessments during planning and development (Robichaud and Anantatmula 2011).

The number of green buildings globally has increased greatly over the last few decades, spurred by rising energy prices, increased general awareness of environmental issues, and stricter

government regulation (Reichardt et al. 2012). Measuring this rise along with the benefits of such building practices is possible because of the numerous certifying organizations that categorize and label buildings as green. The most commonly used certification globally is LEED (Leadership in Energy and Environmental Design), a rating system run by the U.S. Green Building Council. LEED ratings are based on accrued points across six categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation. The sum of the points determine the building's rating: either certified, silver, gold, or platinum (USGBC n.d.). Other rating systems, both in the United States and around the world, are similarly arranged. Some, such as the Energy Star rating system coordinated by the U.S. EPA, focus solely on the energy savings from the building rather than the holistic environmental view that LEED takes. Others, such as the Enterprise Green Community certification, is specifically geared toward low-income communities (Enterprise Community Partners 2019). Many green buildings are designed as green from the initial conception phase, although there are some certifications for existing buildings that are retrofit to be more sustainable.

***Government Oversight***

In addition to general market factors leading to a rise in green building uptake, public agencies at the federal, state, and local level have enacted policies to encourage green building, both through "leading by example" by requiring their own agency buildings to be constructed to highly sustainable standards and by enforcing a green building code for private development. In fact, in 2007 the City of Boston became the first city in the country to require all new construction over 50,000 square feet to be LEED certifiable at a minimum. Boston also established a Green Affordable Housing Program in the same year, requiring new buildings over

50,000 square feet to be LEED certifiable to the Silver level (Burke, Nelson, and Rickerson 2007). The City of Cambridge passed even stricter regulations in 2010, requiring buildings between 25,000-50,000 square feet to be LEED certifiable, large projects to be certifiable to at least the Silver level, and projects in two specific dense and growing neighborhoods to meet LEED Gold standards (Cambridge Development Department n.d.). None of these regulations require obtaining the actual certification through USGBC, just that they could be certifiable. The certification process itself can be prohibitively expensive, although it may also lead to economic benefits, detailed below. These regulations have begun to shift the green building sector from a market-based model to an incentive-based system (Carswell and Smith 2009).

## Benefits of Green Buildings

The benefits of green buildings and certifications are numerous, impacting the building's community socially, economically, and environmentally.

### *Social Benefits*

Green buildings provide measurable benefits to the health and wellbeing of their occupants. A longitudinal study of green affordable housing in Boston found lower rates of sick building syndrome (a range of symptoms associated with poor indoor air quality), asthma symptoms, and hospital visits for residents of green versus conventional buildings (Colton et al. 2015). There is also a growing body of research showing that people who work in green office buildings are more satisfied with the indoor air quality and also more forgiving when there was an element of their building that dissatisfied them (Altomonte and Schiavon 2013; Deuble and de Dear 2009; Gou, Prasad, and Siu-Yu Lau 2013). The focus on air quality reflects a cultural interest in inverted quarantine, as renters are motivated by protecting their health perhaps more than by other advantages that benefit entire communities.

### *Cost Benefits*

Perhaps the most heavily researched aspect of green housing is its economic impacts. There is a certain level of skepticism and concern in the industry that green building is expensive, and it is true that implementing green technologies and becoming certified sometimes leads to higher up-front costs than constructing a conventional building. In almost every case, however, the resulting lowered operating costs more than make up for the initial investment (Bradshaw et al. 2005).

Another hesitation to green building is the "split incentive" for rented spaces: if a lease includes fixed utilities costs, tenants do not receive an economic benefit from restricting their electricity use. On the other hand, if tenants pay the utility bill, landlords have no financial incentive to undertake energy efficient remodeling (Brevard 2012). Despite this concern, there is considerable evidence that green buildings are economically beneficial for both developers and occupants.

A 2018 report by the American Council for an Energy Efficient Economy reviewed 39 academic studies of costs associated with commercial green buildings, of which 27 found positive correlations between green building certifications and rental prices (Zhu et al. 2018). The rent premium is maintained even when controlling for these lower operating costs, suggesting there are other factors that lead to higher rents (Reichardt 2014). Finally, the cost of upkeep in a conventional building, which involves bearing a higher burden of increased energy prices, maintaining older technologies, and responding to increased government regulation, is rarely considered in these cost-benefit analyses (Zuo and Zhao 2014).

Sale and rent premia are evidence that there is a marketing value associated with green certifications. Matisoff, Noonan, and Mazzolini (2014) provide further support that LEED

certification is valued for its marketing purposes. Using a sample of over 5,000 projects, the researchers found the total LEED scores cluster just at or above the cutoffs for each level of the LEED rating, suggesting that developers strive for the benefits of a rating rather than to build as sustainable a building as possible. These findings are in line with the aforementioned Costly Signaling Theory.

### *Environmental Benefits*

Green buildings are, by definition, beneficial to the environment as they require reduced consumption of water and energy and take into consideration the location and resources used in construction. Research on the environmental impacts of green certifications has mostly focused on energy efficiency, most likely because energy use is easily quantifiable, linked to economic savings, and makes up almost a third of the entire LEED rating (Amiri, Ottelin, and Sorvari 2019). Very little research has assessed the lifecycle environmental impacts of green buildings, focusing instead on energy use or, in a few cases, assessing broader impacts only during the construction process (Singh et al. 2011).

In a review of 44 articles related to LEED in office buildings, Amiri et al. (2019) found neutral to positive results for the energy efficiency of LEED buildings, with reductions in energy use ranging from no difference to 39% less energy than conventional buildings. These studies varied widely in location, data collection methods, scale of research, and analysis methods, which may explain some of the variance.

The range of measured energy reduction also speaks to a lack of post-occupancy review, since most, if not all, green certifications are awarded based on the construction and management plan of the building rather than on actual performance. This makes sense because many of the environmental benefits of a building come from one-time design and construction decisions,

including the type of insulation and the appliances installed. Other aspects are controlled entirely by the occupants, such as use of the window shades and HVAC. By certifying before the building is in use, however, green certifications address only the institutional aspects of sustainability, not the impacts of the occupants. The discrepancies in energy reduction might therefore be explained through studying the knowledge, identities, and behaviors of the occupants of green buildings.

For example, surveys of residents of LEED Gold condominium high-rises in Toronto have shown that many residents do not fully understand their energy-recovery ventilation (ERV) systems, and almost half of the residents underused or never used them (Brown and Gorgolewski 2013, 2014). ERV systems are an extremely energy efficient method of heating and cooling air. They also localize temperature control to the individual residence as opposed to a centralized air system, which many conventional buildings have. According to the models of environmental behavior outlined above, knowledge of the ERV system would not necessarily translate to using it but may be a vital first step. Brown and Gorgolewski's research supports this idea since the rate of ERV users was slightly higher than the number of residents who read the ERV manual, but the researchers also report high levels of complaints about the loud noise of the ERV system, an external factor influencing this energy-reducing behavior.

Azizi and Wilkinson (2015) further explore the link between environmental knowledge and energy reduction in green buildings in a study of employees in three office buildings (one certified green, one with green features, and one conventional building). The researchers found that working in green buildings did not increase employees' knowledge of broader environmental issues, but that survey participants from both green and conventional buildings

were motivated to reduce energy use because of a general understanding of energy conservation and expenses.

Other research on occupants of green buildings suggests the importance of visual cues in promoting PEB. In an empirical study using immersive virtual environments, Khashe et al. (2015) found participants placed in a virtual office branded with the LEED logo were more likely to take the pro-environmental actions of using natural light and recycling than those in the control condition without seeing the LEED logo. The participants in the branded condition were also more influenced by environmental values than the control group, suggesting the logo may have increased the salience of their values.

Finally, Wu et al. (2017) proposed applying applied Ajzen's Theory of Planned Behavior (1991) to green building/green occupant studies. Using Ajzen's framework, Wu reviews previous studies and suggests that green buildings passively influence occupants' attitudes, norms, and perceived behavioral control which leads to increased PEB. Wu developed a sample questionnaire that would directly measure these constructs but did not empirically test the questions.

**(Affordable) Green Housing**

As shown above, the majority of research on green buildings focuses solely green office buildings. There is much less written about green residences, especially green multifamily housing. The lack of research may be because the multifamily sector has adopted green building practices at a slower rate than other types of construction, because of the split incentive of energy savings, a lack of interest and knowledge by developers and property managers, and the prevailing thought of property managers that residents are not interested in the benefits of green buildings (Carswell and Smith 2009).

Hopkins et al.'s (2017) qualitative interviews with third-party property managers further explains the property managers' perceptions of to sustainability in the multifamily housing sector. Hopkins et al. find 40% of managers do nothing sustainable. The remaining 60% fall along a spectrum of behaviors: some simply promote basic energy and resource conservation, others also actively market their sustainability efforts, and the top two tiers of managers provide sustainability advisory services and comprehensive environmental evaluations for their owner clients. However, even the management companies with dedicated sustainability staff demonstrated hesitancy and uncertainty for embracing new, green innovations because of the costs. The managers also reported that most consumers are not very interested in sustainable housing, and do not want to pay for it. A few respondents did point out that sustainability is a trend for at millennials and luxury apartment tenants, though.

Carswell and Smith (2009) suggest that Diffusion of Innovation Theory, the idea that new technology will first be adopted by those who truly need it and by those with high monetary and social capital, can explain the trends in green housing. By comparing the geographic distribution of LEED-certified buildings with data on extreme climates from 2000–2008, the researchers found that there has been a diffusion from locales that require high heating or cooling to milder climates, supporting the idea that the technology was first adopted by those who need it. Carswell and Smith also found that LEED-certified multifamily housing is more likely to be in census tracts with high rents, supporting the idea that diffusion begins with those who have wealth and status.

The link between wealth and green housing concerns the authors, who note that this association "creates the real possibility of a bifurcation within the rental housing market, in which the higher-income renters will be attracted more to the benefits of an environmentally

friendly dwelling, with the lower-income population gravitating toward less energy-efficient housing" (Carswell and Smith 2009:76). On a broader scale, some researchers bring up concerns that "greening" a building or a neighborhood has become a code for "whitening" the area, appealing to whiter, wealthier individuals and leading to gentrification (Checker 2011).

In addition to green development spurred by a market of high income individuals and high rents, green building standards are increasingly incentivized and required by governments, particularly within the affordable housing sector. Policy briefs and reports from those involved in affordable housing development prioritize the economic costs and benefits and the associated health outcomes of green housing over the broader environmental impacts (Bradshaw et al. 2005; Burke et al. 2007).

Although important for the affordable housing sector as a whole, cost-benefit analyses are too institutional of an approach to understand the impacts of green development on the individuals residing in green buildings, which is important when measuring environmental benefits. As an initial exploration, Behbehani and Prokopy (2017) used a qualitative, case study approach to explore environmental awareness, attitudes and behaviors of residents of a low-income LEED-certified apartment building. The researchers' findings fit well with existing models of environmental knowledge, identity, and behavior, noting that residents' backgrounds and economic status were key determinants of their association with the environmental features of the building.

For instance, while residents were familiar with their building's geothermal energy system because it was the source of their low and stable energy bills, residents did not identify with the LEED Gold plaque on display, pronouncing it as lead and associating it with lead paint. Residents were also aware of the features in their building that were not environmentally

friendly, such as a lack of recycling bins and poorly located thermostats. More broadly, although residents "did not display care for the natural environment in general, residents did show commitment to specific and individualistic pro-environmental behaviors" (Behbehani and Prokopy 2017:76) such as lowered energy use. They had less interest in water conservation, though, since water was included in the rent. Behbehani and Prokopy conclude their exploratory research with a reminder that low-income households are often left out of the mainstream sustainability debate (Behbehani and Prokopy 2017:80) and call for further research on pro-environmental behaviors and green housing among low-income populations.

**The Present Study**

It is at this intersection of housing, income, and environmentalism that this study takes place. Prior research has shown the predictive power of pro-environmental identity on a range of PEBs, and an individual's home is an important part of their identity (Davidson 2012). What has not yet been studied is if the environmental aspects of green housing are adopted as part of residents' identities and, if so, how that impacts their PEBs outside of the home. In addition, because of a mix of government regulations and market forces, the last decade has seen a proliferation of green multifamily housing as both a luxury good and as an affordable necessity, leading to both increased rents and decreased energy costs. Because income has been shown as a factor influencing environmental identity and behavior, it is important to study how green housing may be having different effects on different people. Based on the literature, my hypotheses are as follows:

- Hypothesis 1: Environmental knowledge, identity, and behavior will all be positively correlated with each other.

    a. The correlation between knowledge and identity will be the weakest of these correlations.
    b. The correlation between identity and behavior will be the strongest.

- Hypothesis 2: Green Housing identity and behavior will fit into the larger patterns of environmental correlations as described in H1.
    a. Housing knowledge and identity will be positively correlated with each other.
    b. The two forms of identity will be positively correlated.
    c. The two forms of knowledge will be positively correlated.
    d. Both will be positively correlated with PEB, identity more so than knowledge.
- Hypothesis 3: Pro-environmental identity and PEB can be predicted by environmental variables and income:
    a. Environmental and housing knowledge will predict PEB.
    b. Housing identity will predict environmental identity.
    c. Environmental identity and PEB will predict each other.
    d. Income will predict both PEB and environmental identity.
- Hypothesis 4: Resident experience (motivations and identity) with green housing will differ between residents of market-rate and affordable housing.
    a. Housing identity will be higher for residents of market-rate housing than for residents of affordable housing; knowledge will not differ between groups.
    b. Residents of affordable housing will be motivated by housing cost above all other reasons.

## METHODS

Following the methods of previous studies on the relationship between environmental behaviors and identity (Clayton 2003; Dunlap and Liere 1978; Stets and Biga 2003; Whitmarsh and O'Neill 2010), I conducted survey research on residents of green multifamily housing in the Greater Boston Area, in both affordable and market-rate buildings.

### Data Collection

Green multifamily properties were initially identified by searching for all green-certified buildings within 10 miles of Boston in the Green Building Information Gateway (GBIG) Database. The GBIG database includes buildings certified through a range of programs, including all versions of LEED, Energy Star, and Enterprise Green Communities. I then contacted the property managers of the multifamily buildings that appeared in my search, briefly discussed the sustainable aspects of their properties, and then asked if it would be possible to distribute a survey to their residents.

Out of the about 200 green multifamily properties identified through the initial database search and then contacted, nine responded in a timely and positive manner. I then worked with the managers of these nine properties to distribute the survey in the method that worked best for each building. In most cases, this meant hosting a "lobby pop-up" for an evening, in which I sat at a table in the lobby of the apartment building and asked residents who walked by if they were interested in filling out a short survey on environmentalism, either on paper or by scanning a QR code and completing the survey electronically. Cookies were available as an incentive for participation. Distributing surveys in person was very beneficial; I could answer any questions about the survey that arose, and some residents initiated conversations with me, sharing details about their experiences with the building.

In addition, fliers were posted ahead of my visit advertising when I would be in the lobby in some of the buildings. In a few cases, the survey was distributed through email or through hand delivery to each door, either instead of or in addition to a lobby pop-up. Data collection took place in February and March of 2019.

## Survey Instrument

The survey used asked questions about general environmental identity, housing identity, environmental knowledge, knowledge of the environmental features of their green housing, PEB, motivation for living in one's current apartment, personal changes in environmentalism since living in one's current residence, and general demographic information. The full survey is in Appendix A. As described below, a composite score was calculated for each of the identity, knowledge, and behavior sections. Survey questions were primarily close-ended, although some respondents using the paper surveys wrote notes on the pages detailing why they chose their answers.

### *Environmental Identity*

Environmental identity was measured using an adaptation of Whitmarsh and O'Neill's (2010) scale, as described in the literature review, in which participants were asked to rate their agreement with statements about their self-image and how others view them in relationship to environmental activities. The composite environmental identity score was calculated as a mean of the four responses.

### *Green Housing Identity*

Green housing identity was measured using a modified version of the scale van der Werff, Steg, and Keizer (2013) used in their study of relationships between biospheric values, environmental self-identity, and environmental behaviors. In the 2013 study, the phrases "Saving

energy is an important part of who I am," "I am the type of person who saves energy," and "I see myself as a person who saves energy" were presented on a 7-point scale. For my study I replaced "saving energy" with "living in green housing" and used a 5-point scale to stay consistent with the environmental identity scale in my survey. The composite green housing identity score was calculated as a mean of the three responses.

### *Environmental Knowledge*

A composite environmental knowledge score was determined through the sum of five true/false statements that measured objective knowledge of the impacts of climate change. Questions about climate change rather than other environmental topics were asked because the energy emissions reductions associated with green buildings are part of Boston's and Massachusetts' goals to mitigate climate change. The questions asked are a subset of those used by Kahan (2015). The narrow focus on objective knowledge differentiates this knowledge score from the identity measure. The statements began with the phrase "Climate scientists believe…" and asked if human-caused global warming will lead to flooding in coastal cities (True), if nuclear power generation contributes to global warming (False), if air temperatures are higher in the early 2000s than the 1990s (True), if human-caused global warming will increase humans' risk of skin cancer (False), and if increased carbon dioxide will reduce plant photosynthesis (False).

### *Knowledge of Green Housing*

To measure the level of understanding of the green features of one's building, participants were asked to check if the following features were in the building: low flow toilets and showers, energy-efficient kitchen appliances, constructed from reused materials, low-emissions paint and carpets, energy-efficient ventilation, energy-efficient insulation, and other

features. Space was provided for respondents for write-in responses when listing an "other" feature. Through conversations with the property managers and reading through the LEED certification documentation for the buildings, I determined which of the features were truly present in each building. The nine buildings at which I conducted my survey had all the features listed except for reused materials, so that question was eliminated from the analysis and a composite housing knowledge score was calculated as the sum of checked responses for the section. Participants who wrote a response in the "other feature" line were given an extra point if their response was accurate.

***Pro-Environmental Behavior***

As explained in the literature review, there is no consensus on how to measure, or which acts should define, PEB. Many of the scales which do exist have ask about over 20 behaviors and, since my survey includes many other measurements, including a full behavioral scale would have made the overall survey excessively long. The 13 items that were chosen are informed by many studies of PEB, including (Markle 2013; Whitmarsh and O'Neill 2010). These items cover most of the broad subcategories of PEB, including transportation, energy, water, and waste behaviors, as well as both public and private behaviors. Unlike many previously used scales, no questions on home maintenance were included since upkeep of a rental unit is very different than weatherizing and maintaining a house. Participants were asked to indicate if they engaged in the listed behaviors Always, Often, Sometimes, or Never. The composite pro-environmental behavior score was calculated as a mean of the 13 responses.

***Motivation for Green Housing***

To account for and to understand the reasons that led to moving to green housing, participants were asked to rank the following options in the order in which they influenced their

decision to reside in their current apartment: distance from work/school, distance from family/friends, sustainable building features, housing cost, neighborhood features, and other reasons. Space was provided to write in the other reason. Participants ranked only the options that were relevant, leaving some blank.

### *Change in Environmentalism*

The survey ended with three questions that asked participants to report how their relationship to environmentalism has changed since living in a green building. The questions asked if respondents' knowledge of sustainable building features, interest in environmentalism, and tendency to take pro-environmental actions had increased, decreased, or stayed the same since living in their current building. The responses to these questions cannot be used as a direct measure of the impact of the building on participants' knowledge, interests, and behaviors — there may be other, cofounding variables leading to changes over time — but the responses do indicate if change has occurred at all.

### *Demographic Information*

Participants indicated their gender, age, length of residence in the building, household size, education, and household income through a series of multiple choice questions.

## RESULTS

A total of 120 green apartment residents responded to the survey, 21 residents from affordable buildings and 98 residents from market-rate units. Some respondents left parts of the survey blank or answered "preferred not to say" when asked for their education and income level. These partial survey responses are included only when possible.

### Descriptive Statistics

#### *Defining the Survey Sample*

Compared to the American Community Survey 2017 estimates, the gender composition of the survey respondents is very similar to the Boston Metro Area (48% male/52% female). The sample population is more educated and wealthier than the overall Boston Metro population, likely because the majority of respondents resided in market-rate units; almost all of the residents of market-rate housing have at least a bachelor's degree (93.3%) and 63.6% make over $100,000 per year. A detailed description of the sample's demographics is shown in Table 1.

There are significant demographic differences between the residents of affordable and market-rate green housing. There are very significant ($p < .001$) differences in education $\chi^2$ (5, $N$ = 116) = 28.50, income $\chi^2$ (6, N = 98) = 64.29, household size $\chi^2$ (3, $N$ = 117) = 27.80, length of residence $\chi 2$ (3, $N$ = 116) = 55.24, and age $\chi 2$ (3, $N$ = 117) = 30.46. There is also a slight significant difference in gender between building types $\chi 2$ (1, $N$ = 4.47) = 4.47, $p$ = .04). Residents of market-rate housing who responded to the survey are younger, have lived in their current building for fewer years, have higher household incomes, are more educated than the residents of affordable housing, and are slightly more likely to be male, as seen in charts 1–6.

*Table 1: Demographic Data of Survey Sample*

| | Frequency | Percent |
|---|---|---|
| **Housing Sector** | | |
| Affordable | 29 | 24.37 |
| Market-Rate | 90 | 75.63 |
| **Length of Residence** | | |
| Less than 1 year | 39 | 33.33 |
| 1-3 years | 55 | 47.01 |
| 4-7 years | 10 | 8.55 |
| 7+ years | 13 | 11.11 |
| **Household Size (# Adults)** | | |
| 1 | 44 | 37.29 |
| 2 | 62 | 52.54 |
| 3 | 8 | 6.78 |
| 4 or more | 4 | 3.39 |
| **Gender** | | |
| Female | 61 | 53.04 |
| Male | 54 | 46.96 |
| **Age** | | |
| 18-24 | 11 | 9.32 |
| 25-44 | 74 | 62.71 |
| 45-64 | 20 | 16.95 |
| 65 and over | 13 | 11.02 |
| **Education** | | |
| Less than a high school degree | 2 | 2.54 |
| High School diploma | 5 | 4.24 |
| Some college, no degree | 8 | 6.78 |
| Associate degree | 3 | 2.54 |
| Bachelor's degree | 49 | 41.53 |
| Postgraduate degree | 50 | 42.37 |
| Prefer not to say | 1 | 0.85 |
| **Yearly Household Income** | | |
| Less than $20,000 | 11 | 9.48 |
| $20,000–$34,999 | 12 | 10.34 |
| $35,000–$49,999 | 5 | 4.31 |
| $50,000–$74,999 | 10 | 8.62 |
| $75,000–$99,999 | 11 | 9.48 |
| $100,000–$129,999 | 12 | 10.34 |
| Over $130,000 | 37 | 31.90 |
| Don't know/Prefer not to say | 18 | 15.52 |

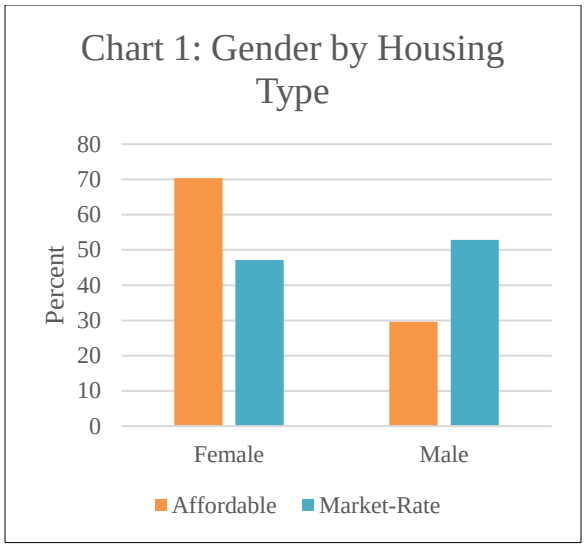


Chart 1: Gender by Housing Type
Percent
80
70
60
50
40
30
20
10
0
Female
Male
Affordable
Market-Rate

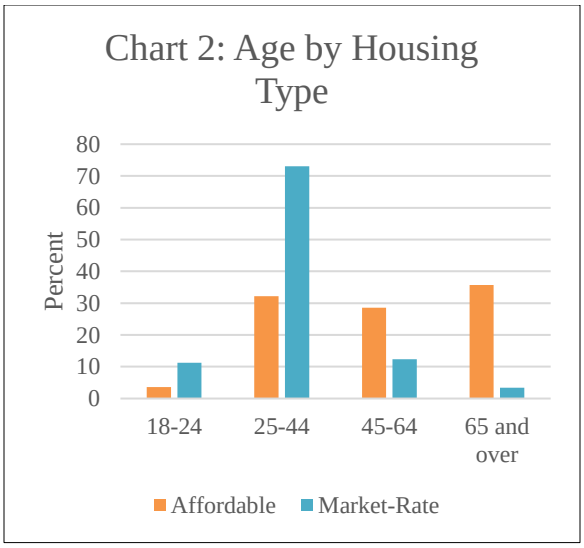


Chart 2: Age by Housing Type
Percent
80
70
60
50
40
30
20
10
0
18-24
25-44
45-64
65 and over
Affordable
Market-Rate

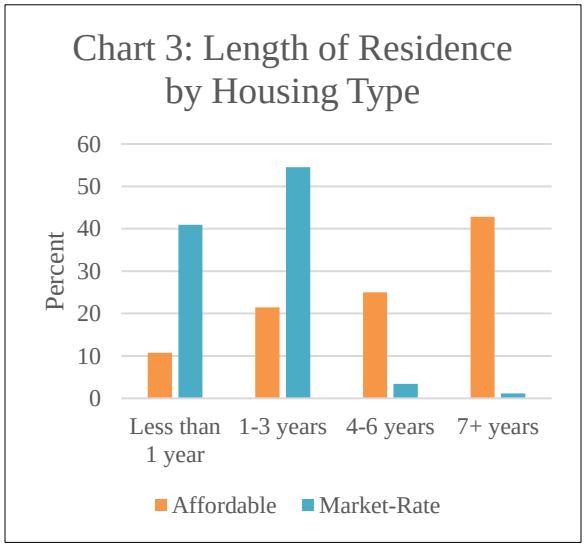


Chart 3: Length of Residence by Housing Type
Percent
60
50
40
30
20
10
0
Less than 1 year
1-3 years
4-6 years
7+ years
Affordable
Market-Rate

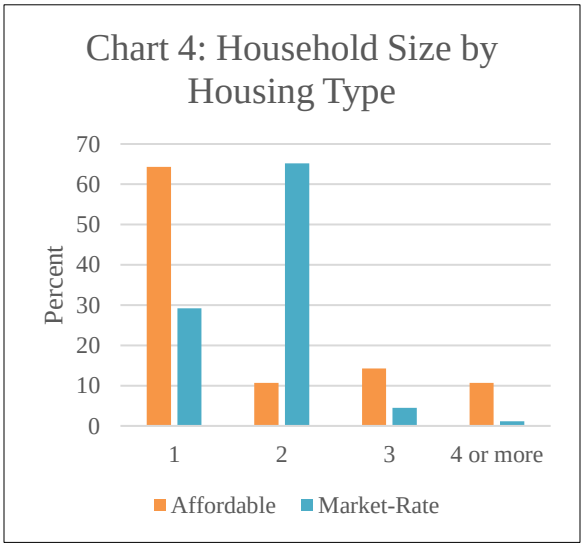


Chart 4: Household Size by Housing Type
Percent
70
60
50
40
30
20
10
0
1
2
3
4 or more
Affordable
Market-Rate

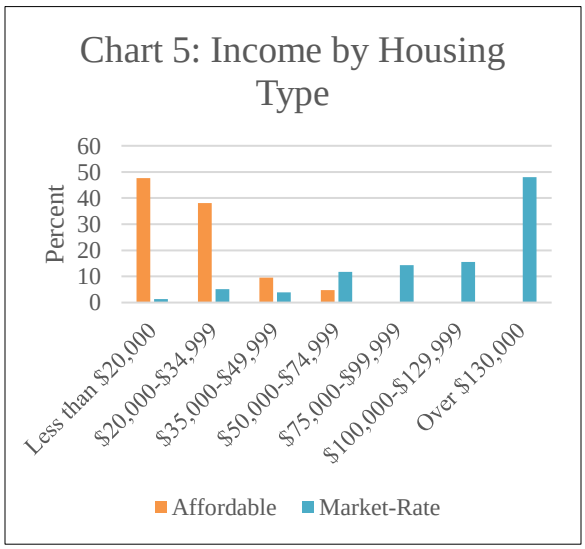


Chart 5: Income by Housing Type
Percent
60
50
40
30
20
10
0
Less than $20,000
$20,000-$34,999
$35,000-$49,999
$50,000-$74,999
$75,000-$99,999
$100,000-$129,999
Over $130,000
Affordable
Market-Rate

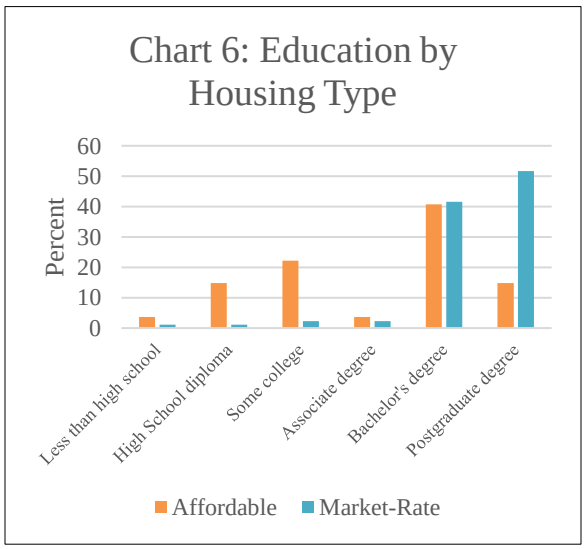


Chart 6: Education by Housing Type
Percent
60
50
40
30
20
10
0
Less than high school
High School diploma
Some college
Associate degree
Bachelor's degree
Postgraduate degree
Affordable
Market-Rate

### *Creating Composite Variables*

As described in the methods section, most of the composite environmental variables were constructed from previously used and verified scales. An analysis of the Cronbach's alpha of the scales for this study shows the identity and behavior scales remained valid in this study. The housing identity scale ($\alpha = .83$) and pro-environmental behavior scale ($\alpha = .76$) passed the generally accepted $\alpha > .70$ threshold (Peterson 1994). The total environmental identity scale was just under the .70 threshold, with $\alpha = .67$. This lower value may be explained because two of the four questions were worded negatively, and some respondents may not have noticed the opposite wording and therefore marked the opposite of what they would have chosen. The alpha values for the pairs of environmental identity questions, positive and negative, are both .80. All statistical tests reported in this study were conducted on both the mean of all four questions and the score made from averaging just the two positively worded questions. All tests showed the same results, with slightly stronger adherence to the models from the score based on only two questions. Because of this higher consistency, all further references to environmental identity scores in this analysis refer to the mean value of the two positively worded environmental identity questions.

Cronbach's alpha is a measurement of inter-correlation, making it very applicable for Likert scale scores such as the identity and behavior measures. Validity of the knowledge scale, however, cannot necessarily be measured by alpha because some of the questions are easier than others, meaning the inter-correlation will not be evenly distributed. In the environmental knowledge scale, for example, 96% of respondents correctly marked that climate scientists believe that human-caused global warming will result in flooding of many coastal regions, but only 27% of respondents correctly indicated that the statement "climate scientists believe that

the increase of atmospheric carbon dioxide associated with the burning of fossil fuels will reduce photosynthesis by plants" is false. On the other hand, the housing knowledge scale displays acceptable inter-correlation ($\alpha = .73$), suggesting that no single feature of the buildings is more understood by residents than another. Table 2 reports the means and standard deviations for the composite environmental scores.

*Table 2: Descriptive Statistics for Composite Environmental Scores*

| Variable | *N* | *M* | *SD* | Range |
|---|---|---|---|---|
| Environmental Identity | 119 | 4.15 | .82 | 1-5 |
| Environmental Knowledge | 113 | 2.73 | 1.05 | 1-5 |
| Green Housing Identity | 111 | 3.58 | .83 | 1-5 |
| Green Housing Knowledge | 110 | 2.12 | 1.73 | 0-6 |
| Pro-Environmental Behavior | 119 | 2.48 | .48 | 1-4 |

**Hypotheses 1 and 2: Correlations between Knowledge, Identity, and Behavior**

A Spearman's correlation was used to test the relationships between the composite environmental scores. As shown in Table 3, there were significant correlations between many of these measures.

*Table 3: Correlation Between Environmental Scores*

| Variables | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Environmental Identity | 1.00 | | | | |
| 2. Environmental Knowledge | .17 | 1.00 | | | |
| 3. Housing Identity | .48** | .08 | 1.00 | | |
| 4. Housing Knowledge | .16 | -.30** | .30** | 1.00 | |
| 5. Pro-environmental Behavior | .54** | .26** | .30** | .16 | 1.00 |

*$p < .05$ ** $p < .01$

Hypothesis 1 is mostly supported. PEB is significantly positively correlated with both environmental identity and environmental knowledge, and the correlation between PEB and environmental identity is the strongest of all correlations, as expected by hypothesis 1(b).

Hypothesis 1(a), however, is not fully supported. The relationship between environmental knowledge and environmental identity is weaker than the relationship between either one's relationship with PEB, but it is only moderately significant ($p$ = .08).

Hypothesis 2 is also somewhat supported by the correlation. Housing identity is positively correlated with housing knowledge, environmental identity, and PEB (hypotheses 2(a), (b) and (d)). Housing knowledge has a weak and moderately significant correlation with PEB ($p$ = .09), and a strong but negative correlation to environmental identity, which does not support hypothesis 2(c). The negative relationship is unexpected and should be explored through further study.

**Hypothesis 3: Predicting Identity and Behavior**

Multiple regression models were run to test hypothesis 3, that environmental identity and PEB are predicted by environmental and demographic factors. Table 4 shows the predictive power of environmental factors on environmental behavior. The overall model is weak but significant, suggesting there may be other factors that have strong influences on behavior. Hypothesis 3(a) is not supported, since neither environmental knowledge nor housing knowledge have a significant effect on PEB, although environmental knowledge has a moderate beta value and $p < .10$.

*Table 4: Regression Analysis for PEB, $R^2 = 0.17$, $p < .001$, $N = 107$*

| | b | SE | t | p | β |
|---|---|---|---|---|---|
| **Environmental Identity** | **.19** | **.06** | **3.37** | **.00** | **.35** |
| Environmental Knowledge | .07 | .04 | 1.74 | .09 | .17 |
| Housing Identity | .01 | .06 | .25 | .81 | .03 |
| Housing Knowledge | .04 | .02 | 1.42 | .16 | .14 |

A regression of environmental factors on environmental identity was performed and is shown in Table 5. Hypothesis 3(b) was supported, as housing identity is a strong and significant predictor of environmental identity. Hypothesis 3(c) is also supported, as environmental identity and PEB are the strongest predictor in both models.

*Table 5: Regression Analysis for Environmental Identity, $R^2 = .31$, $p < .001$, $N = 107$*

| | b | SE | t | p | β |
|---|---|---|---|---|---|
| **PEB** | **.52** | **.16** | **3.37** | **.00** | **.29** |
| Environmental Knowledge | .04 | .07 | .70 | .49 | .06 |
| **Housing Identity** | **.41** | **.08** | **4.85** | **.00** | **.42** |
| Housing Knowledge | .01 | .04 | .16 | .87 | .01 |

To test hypothesis 3(d), income was added to the existing regression models. Income has a significant and positive influence on environmental identity. The full regression is shown in Table 6. For the model of PEB, shown in Table 7, income has no effect and the model itself becomes extremely weak. Income is therefore predictive only of environmental identity and not behavior.

*Table 6: Regression Analysis for Environmental Identity Including Income, $R^2 = .29$, $p < .001$, $N = 92$*

| | b | SE | t | p | β |
|---|---|---|---|---|---|
| **PEB** | **.45** | **.17** | **2.62** | **.01** | **.24** |
| Environmental Knowledge | .02 | .07 | .37 | .714 | .04 |
| **Housing Identity** | **.42** | **.09** | **4.65** | **.00** | **.43** |
| Housing Knowledge | .01 | .05 | .33 | .74 | .03 |
| **Income** | **.07** | **.03** | **2.04** | **.04** | **.19** |

*Table 7: Regression Analysis for PEB Including Income, $R^2 = .08$, $p = .03$, $N = 92$*

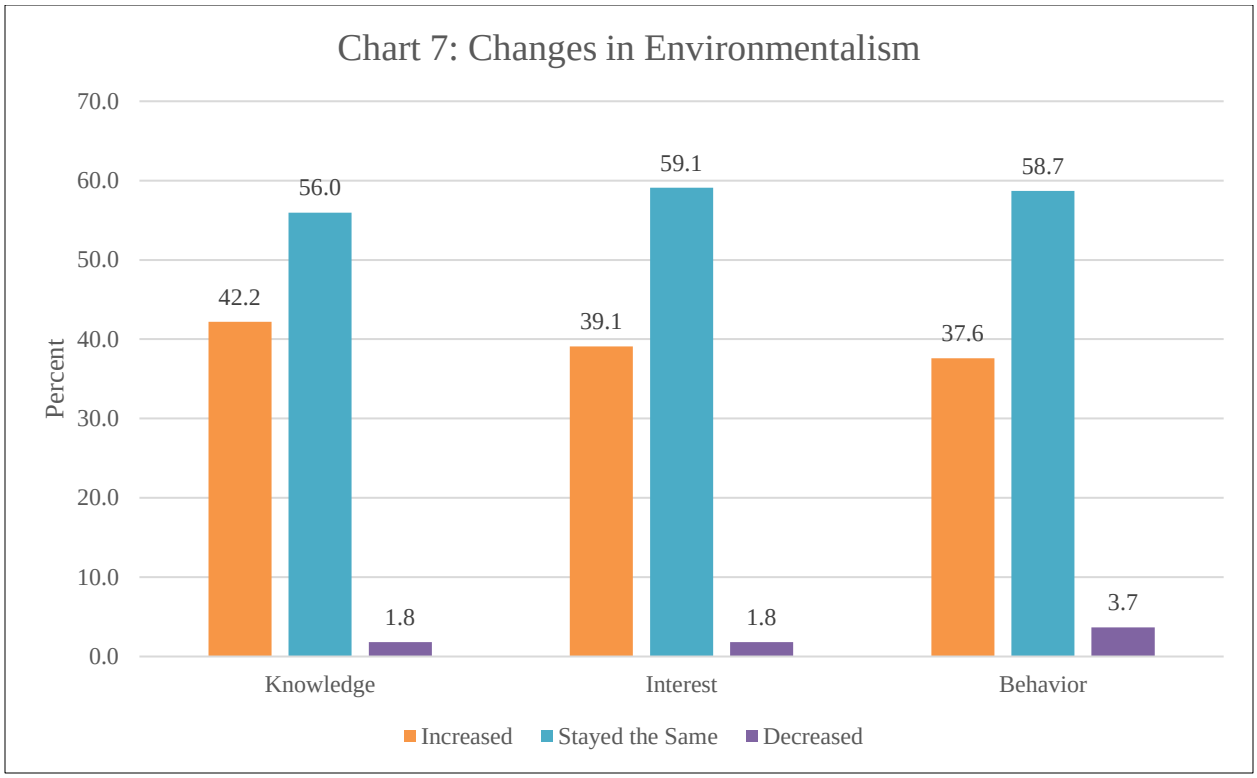
| | b | SE | t | p | β |
|---|---|---|---|---|---|
| **Environmental Identity** | **.16** | **.06** | **2.62** | **.01** | **.31** |
| Environmental Knowledge | .07 | .04 | 1.59 | .11 | .18 |
| Housing Identity | -.03 | .06 | -.49 | .63 | -.06 |
| Housing Knowledge | .03 | .03 | 1.03 | .31 | .12 |
| Income | .00 | .02 | .04 | .97 | .00 |

Because environmental identity and PEB are strongly correlated and research suggests there is a spillover effect in which the two factors influence each other rather than one predicting the other, the relationship between these two variables and income was studied through correlation as well as regression. In light of the result that income influences environmental identity but not PEB, an analysis of the correlation between the two environmental scores when controlling for income was run.

Income brackets were condensed from the seven brackets listed on the survey into three larger categories (Less than $34,999; between $35,000 and $99,999; and above $100,000) to create larger groups that would not diminish the power of the analysis. While the correlation remained strong and significant for the middle income ($r_s(26) = .56$, $p < .01$) and high income ($r_s(49) = .60$, $p < .01$) groups, there is a much weaker and not significant correlation for the lowest income group ($r_s(23) = .20$, $p = .35$). These findings suggest that income level not only predicts environmental identity but also mediates the relationship between environmental identity and PEB.

**Hypothesis 4: Understanding Green Housing Experiences**

One-way ANOVA tests were conducted to test hypothesis 4(a), comparing housing type to housing knowledge and then to housing identity. The analysis showed housing type does not have a significant effect on housing knowledge ($F(1,107) = 2.95$, $p = .09$) or housing identity ($F(1,108) = .27$, $p = .61$). Almost all residents reported their housing knowledge, interest in environmentalism, and environmental behavior either stayed the same or increased since moving into their current green apartment building, as shown in chart 7.

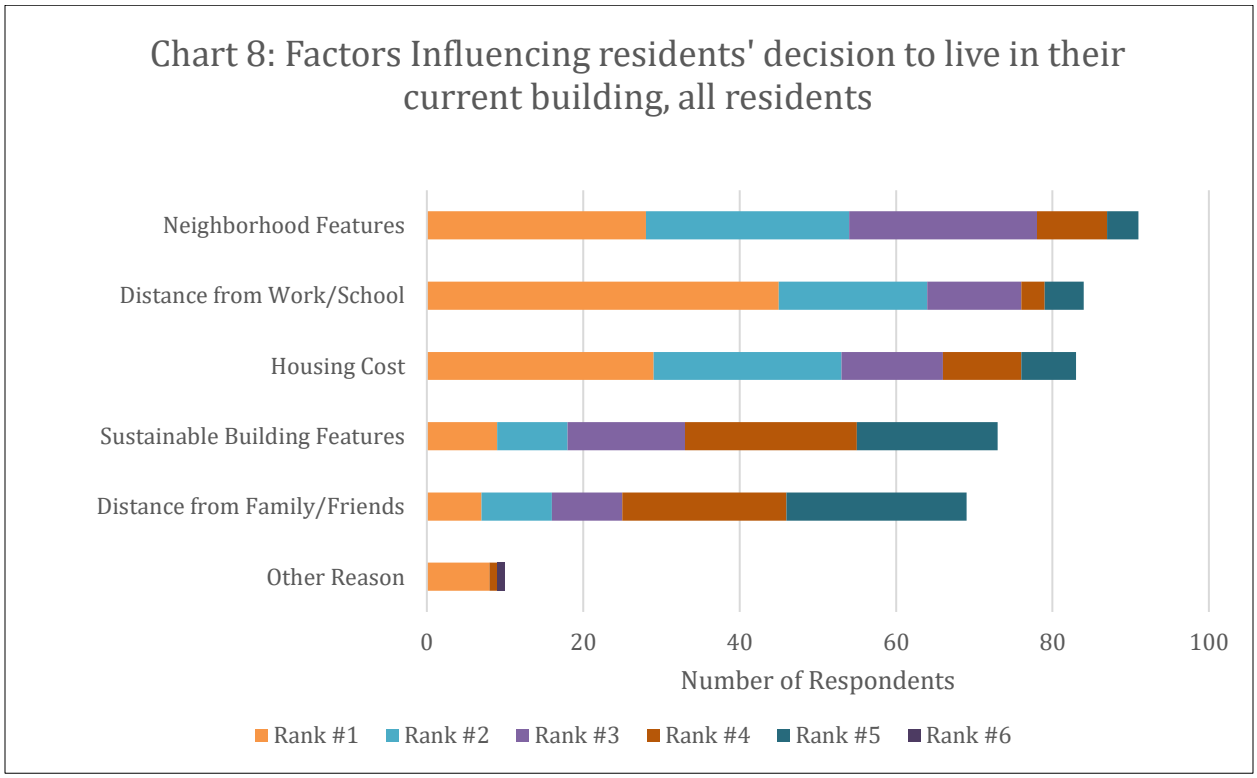



Residents' relationships with their housing is further understood through an analysis of their reasons for moving into their current apartments, as proposed by hypothesis 4(b). Charts 8–10 display the rankings given to each of the reasons listed on the survey. The difference in total responses for each factor is because survey respondents were instructed to rank only the options that influenced their decisions and leave the rest blank. In addition, a few respondents ranked multiple items with the same number, leading to more #1 rankings than survey respondents. These responses were included as-is, interpreted as indication that multiple reasons were equally and strongly influential. The other reasons option was rarely chosen, and those who did rank it wrote in unique responses such as medical reasons, a great view, and security.

As seen in the charts below, building sustainability is not a top priority when determining where to live, as it was ranked fewer times than neighborhood features, distance from work/school, and housing cost overall. When respondents did rank building sustainability as an

influencing factor, it was ranked as fourth or fifth more often than first, second or third. The moderate influence of sustainable building features held for both types of housing.

There are other marked differences in the factors that influence residents of affordable and market-rate housing. Most notably, housing cost is much more important for residents of affordable housing. Not only is housing cost the most rated item, it is also always rated either first or second.



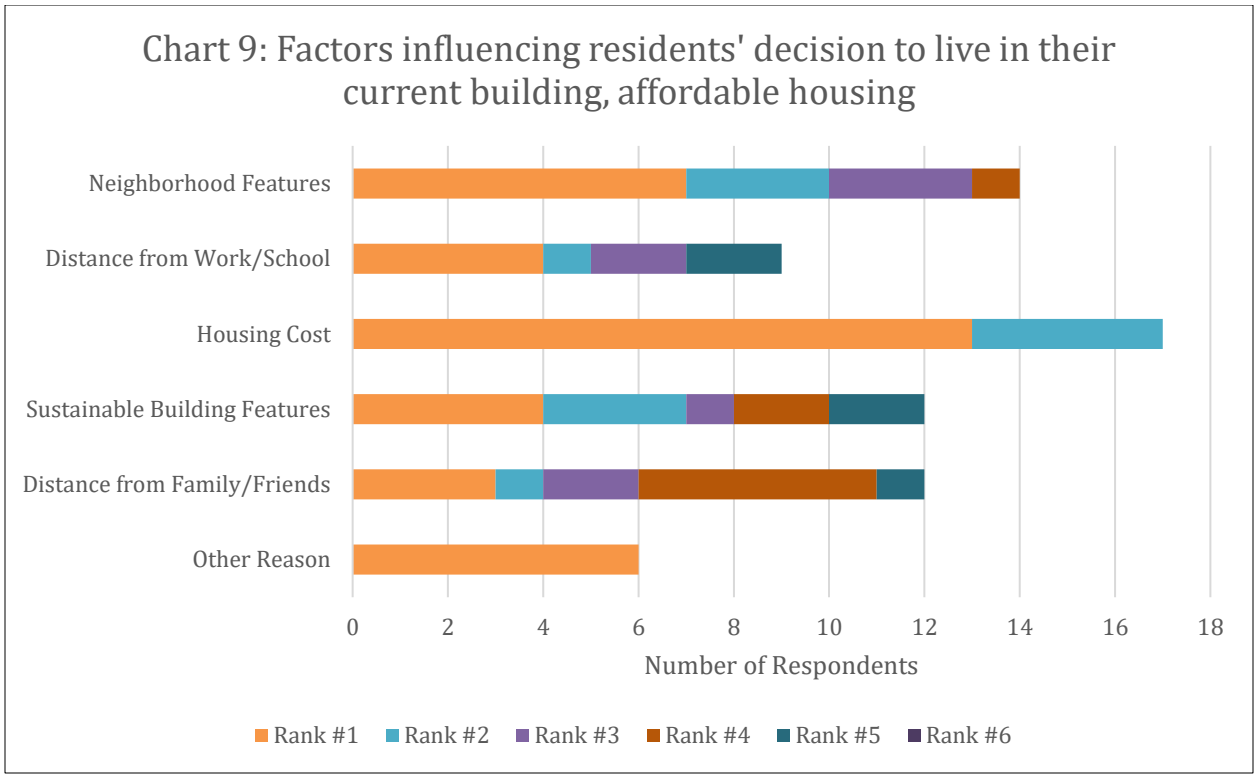


Chart 9: Factors influencing residents' decision to live in their current building, affordable housing
Neighborhood Features
Distance from Work/School
Housing Cost
Sustainable Building Features
Distance from Family/Friends
Other Reason
0
2
4
6
8
10
12
14
16
18
Number of Respondents
Rank #1
Rank #2
Rank #3
Rank #4
Rank #5
Rank #6

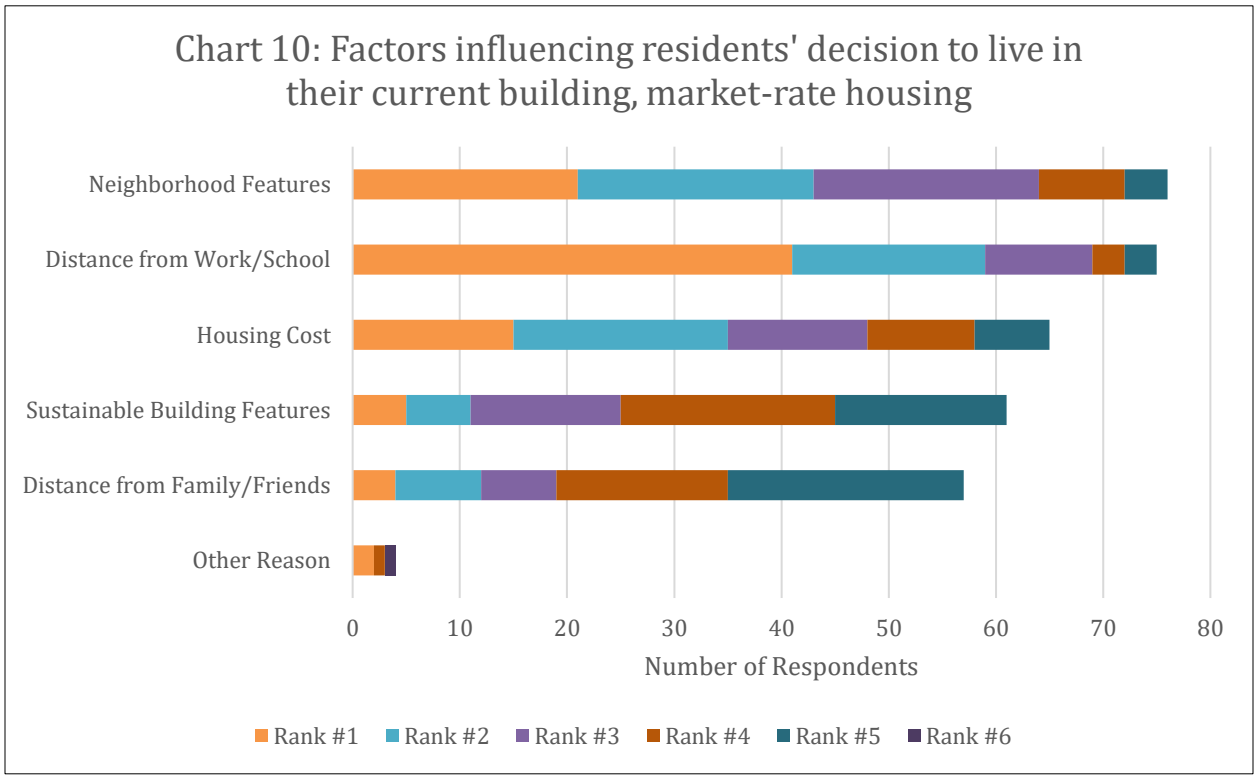


Chart 10: Factors influencing residents' decision to live in their current building, market-rate housing
Neighborhood Features
Distance from Work/School
Housing Cost
Sustainable Building Features
Distance from Family/Friends
Other Reason
0
10
20
30
40
50
60
70
80
Number of Respondents
Rank #1
Rank #2
Rank #3
Rank #4
Rank #5
Rank #6

A post hoc analysis of the relationship between green housing identity and knowledge of green housing features shows this relationship is mediated by housing type. Overall, housing identity and knowledge were correlated, $r_s(108) = .31$, $p < .01$. When controlling for housing type, though, a difference emerged. While the identity-knowledge correlation was maintained and increased for residents of affordable housing $r_s(27) = .51$, $p < .01$, the correlation is weaker and only moderately significant for residents of market-rate housing, $r_s(82) = .20$, $p = .07$. In other words, residents of market-rate housing do not associate their connection to their green housing with their actual knowledge of the green features in the building.

Hypothesis 4 is therefore mostly supported. Hypothesis 4(b) is supported, since the importance of housing cost varied between housing types. Hypothesis 4(a) is partially supported, since of housing identity and knowledge are not predicted by housing type, but the relationship between these two scores is mediated by housing type.

## DISCUSSION

This study explored the relationship between environmental knowledge, identity, and behavior of individuals of different socio-economic statuses who live in green multifamily housing. The survey responses align with previous research on the general connection between these three environmental attributes and provide insight into how these attributes relate to economic status and green housing.

The first major finding of this study is that residents of green housing show similar relationships to environmental knowledge, identity, and behavior as others do: Environmental knowledge is correlated with PEB, but the relationship is not as strong as that found between identity and PEB. In addition, the relationship between identity and behavior is likely reinforcing, as the two are highly correlated and predict each other. These relationships show this is a reliable study and suggest that residents of green housing are not different than the general populations that have been studied previously (e.g., Stets and Biga 2003; Whitmarsh and O'Neill 2010).

The regression model for PEB was much weaker than the model for environmental identity, suggesting there may be other factors that also lead to PEB. Considering the weak PEB model and stronger identity model, this result aligns with the conclusions from previous research on spillover effects — that engaging in one PEB can lead to others, especially if the first action is associated with identity. The initial PEB may be motivated by a range of other reasons but, once the initial behavior is linked with environmentalism, the individual becomes more likely to engage in further PEB. This study highlights the power of identity and suggests that efforts made to increase the salience and importance of environmental identity will lead to increased environmental behavior.

A second key finding is that environmental behaviors are predicted by identity much more so than by an understanding of climate science and of sustainable infrastructure, suggesting individuals have a vague understanding that behaving in environmentally friendly ways is good, but not knowing the details of why or how their actions will make a difference. The discrepant connections between knowledge and behavior and identity and behavior speak to viewing environmental behaviors as a status signifiers rather than as actions taken with a purpose of having an impact.

**Environmental Identity and Economic Status**

Analysis of the survey results show that income influences environmental identity and the relationship between environmental identity and PEB, but income does not predict PEB on its own. The predictive influence of income on identity and the finding that the two are correlated only for households with middle and high incomes reinforces the concepts explored by Carfagna et al. (2014), that there is social capital to be gained from engaging in PEB. This finding has important implications for the future of promoting behaviors as environmental. While such a label may lead to increased environmental identity, which would lead to more PEB, it may also classify behaviors as activities that only those of a higher economic status partake in.

On the other hand, the fact that income does not predict PEB directly speaks to the broad range of activities that are classified as PEB. As Sadalla and Krull (1995) and Moser and Kleinhückelkotten (2018) show, there are some cases in which environmental behavior are costly and some that are cost saving. Some PEB are very public actions, which easily project one's environmental identity to others, while some actions are much more private. This is why the lack of a significant correlation between identity and behavior for lowest income group is interesting, suggesting that while identity may motivate behavior for individuals with higher economic

statuses, environmental behavior is motivated by other factors for low-income individuals. Prior research has begun to explore these links, such as Behbehani and Prokopy's (2017) observations that low-income individuals participate in energy conservation behaviors because of a desire to have a lower energy bill, but that the same individuals were less likely to conserve water because they did not pay a water bill. Further study of the identities and connotations of all PEB will allow for city planners, green companies, and others interested in promoting environmental action to understand which groups of people are likely to already be involved in such behaviors and how to properly advertise the behavior to groups who are not engaged.

### Applications to Green Multifamily Housing

In the specific realm of green multifamily housing, green housing identity and knowledge of environmental features in the building are correlated with each other, their respective environmental factors, and PEB. Housing identity and knowledge are not influenced by housing type, although the correlation between the two variables is. Residents of market-rate and affordable housing reported differing reasons for moving to their current green apartment, with residents in market-rate buildings prioritizing distance from work and residents of affordable units prioritizing cost. Neither group strongly prioritized sustainable building features. Slightly under half of the respondents reported increased environmentalism since living in their current green housing, and most of the others indicated their environmental interest, knowledge, and behaviors had stayed the same.

An important finding from the analysis is the overall lack of knowledge of green housing features. Knowledge of the environmental features in the building is the only composite variable with a mean score of less than the 50% mark on the scale and, although housing knowledge is correlated with green housing identity, it is not correlated with nor predicts general

environmental identity or PEB. Despite the lack of knowledge, many residents still feel connected to and identify with the fact that their building is green, and housing identity was predictive of both general environmental identity and PEB. The relationships between housing knowledge, identity, and behavior align with previous research on predicting environmental behavior (Carmi et al. 2015; Kollmuss and Agyeman 2002).

The similarities between general populations and green housing residents — as well as residents' overall limited knowledge of the environmental features in the buildings — suggest that these residents are not a unique group of environmentalists motivated to live sustainably, which one may have expected. Instead, these individuals are merely a subset of the population of the Greater Boston Area, with just as broad a range of environmental identity, knowledge, and behaviors as the public. This is important because it shows that we have reached extensive diffusion of innovation of green buildings, since what started as new technology for a select few who needed or could pay extra for it is now becoming a standard aspect of city life, promoted by market forces and government regulations (as predicted by Carswell and Smith 2009).

The fact that housing type does not predict housing knowledge or identity is important: both sets of residents saw themselves as the type of person who would live in green housing (mean housing identity score of 3.58, between neutral and agree), although neither know much about what green housing means. As the analysis of factors influencing residents' move to their current housing shows, residents place a higher importance on many other reasons for living in the building besides the environmental benefits of their buildings. The lack of knowledge and low importance of the features in the building points to the general conclusion that the green impact of one's housing is not a prominent aspect of residents' lives. This validates property managers' views that "there is tepid demand for 'green' apartments, and even when consumers

care they are rarely willing to pay for it in any substantial way" (Hopkins et al. 2017). In addition, the fact that housing identity and housing knowledge are not as strongly correlated for residents of market-rate housing once again suggests that identifying with environmentalism takes precedence over truly understanding environmental impacts and reducing them.

While further research is necessary to understand the quantifiable impacts of living in green housing, this study shows green housing has an indirect influence on individuals' overall green behaviors. Although housing identity does not directly predict PEB, housing identity predicts environmental identity which then influences PEB. This indirect link is a potential benefit of green buildings, as they may be the catalyst to a cycle of increased environmental identity and PEB. Further research is necessary, however, to determine exactly what leads to identification with green housing. On the other hand, this study did not find factors such as length of residence or housing type to influence housing identity. In fact, slightly less than half of all survey respondents indicated their knowledge of environmental building features, interest in environmentalism, and PEB increased since moving to their current apartment. However, drawing from Khashe et al.'s (2015) finding that individuals were more likely to engage in PEB when primed with a visual reminder that the building in which they were in is LEED certified, it appears that a way to encourage identification with one's green housing is to promote the building's sustainability. It is not enough to simply live in a green-certified building, residents must also be aware of the fact the building is sustainable in order to identify with it.

**Qualitative Analysis**

Conducting in-person surveys and establishing connections with building property managers and Boston-area green development officials led me to a greater understanding of green multifamily housing, and further supports my findings. The following information was

collected through discussions I had with property managers while planning my data collection and with residents who filled out the survey, both in discussion and in notes on the paper surveys.

In line with Hopkins et al. (2017), the third-party property managers operating the green buildings had a range of views toward their building's sustainable features. Some were extremely knowledgeable about the building and talked about using the green features as a selling point. Others had only vaguely heard the building was certified and did not know any details. A few property managers pointed out that they were required by city law to meet LEED standards, or that all other comparable apartments in the area are certified, and therefore their building was not commendable or unique. A common comment from the property managers was the benefit of reduced energy costs. This is interesting because market-rate respondents indicated they were not motivated to choose their housing because of the costs and, based on prior research on rent premia, these buildings are likely more expensive than conventional apartment buildings. However, even those who are live in expensive apartments may still be interested in saving on monthly utility bills.

Because most of the respondents completed a paper version of the survey, those who felt the urge to provide more detail than requested by the questions had room to do so in the margins. Multiple respondents wrote notes, especially about the questions relating to environmental knowledge. Many residents underlined words or wrote in phrases such as "I'm not sure about this," reinforcing the finding that respondents are generally not very knowledgeable about environmental topics. Multiple residents also commented on the behavior of composting, noting that they would like to be composting but their apartment does not have the resources to do so:

Here is an example of how green buildings are not as green as they could be, on a building level rather than because of lack of interest of the residents.

Finally, many of the respondents — from both affordable and market-rate housing — were surprised when I said that their apartment was a green building. In many cases while at the market-rate buildings, the residents reacted to this news with a nod or simple question asking for more details. In a few cases with residents of affordable housing, however, a handful of residents actively told me that their building was not green. Their reasons why ranged from that it doesn't have a composting bin to that the indoor air quality is poor because of broken furnaces and people smoking. These comments, in addition to the finding that there is a discrepancy between housing identity and knowledge for residents of affordable housing, point to a need for further exploration of the experience of living in green affordable housing.

**Policy Implications**

Overall, environmental identity more than any other factor predicts PEB. Although data on environmental impacts rather than behavioral intent would be helpful, this study as well as prior research point to the benefits of making environmental identity salient to individual to encourage increased PEB. Based on this research, city officials and other who are interested in promoting PEB should focus on general concepts of environmental benefits rather than trying to teach specific environmental science knowledge, unless for some reason the detailed knowledge is necessary for completing a target behavior, such as operating an ERV system (Brown and Gorgolewski 2014).

Specifically, this study found that housing identity predicts general environmental identity which predicts PEB. This finding suggests that increased sustainable development may

encourage increased engagement in PEB overall. Based on the low importance of environmental and housing knowledge, it is not important for green housing developers and property managers to share detailed information on the features of building, but advertising that the building is sustainable will likely increase residents' identification with green housing.

However, advertising the sustainable features of a residence may not be the most effective marketing strategy, since residents are motivated to move into green buildings for a variety of reasons other than their sustainable features, such as distance from work and housing cost. Because of these other interests, the recent trends in the housing sector toward incentive- and regulation-based sustainability rather a market-driven system are even more important. Sustainable building features are already not be the key reason why residents choose a new home. As green design increasingly becomes commonplace, choosing a home for its environmental features will only become less relevant since sustainability will be the status quo. Standardizing sustainability across the housing sector also ensures equitable access to the personal benefits of green buildings, such as the health benefits of indoor air quality.

Increased government incentives and regulations to promote green housing also help governments address their environmental goals. For example, approximately 20% of Boston's greenhouse gas emissions currently come from residential housing, and the city has a stated goal of reducing residential emissions by about 100,000 metric tons of carbon dioxide by 2020 (City of Boston 2014). Reaching this goal will likely require both building upgrades and behavior change, a combination of institutional and individual efforts.

## Limitations and Future Research

This study is an initial exploration of the relationship between environmental knowledge, behavior, and identity; green housing benefits; and economic status. The findings show that there is reason to connect these topics and provides an initial analysis of how these three concepts overlap. As an initial exploration, this study suggests few conclusions and many questions for further research.

First, it is important to note that this study was limited by its small sample. A larger sample would allow for more powerful statistical tests, such as regressions on more than one demographic variable. A larger sample would also address the uneven distribution of responses between residents of market-rate and affordable housing that this study has. My access to residents of green affordable housing was somewhat limited because I was told by multiple property managers that many of their residents were immigrants and were not fluent in English. Due to time constraints I did not translate the survey to other languages, so I did not reach this population. It is important to include them in further studies, not only to increase the sample size of residents of affordable housing but to account for other cultural factors that may influence immigrants' environmental identities and behaviors.

One important next step in researching environmentalism and green housing is to make comparisons between the residents studied in this research and controls. First, it would be beneficial to compare environmental knowledge, identity, and behavior of residents in both certified and conventional housing, leading to a better understanding of the impact of housing identity. It would also be valuable to compare self-reported identities and behaviors with data from electricity and water meters, to understand not just the number of activities but the

measurable impact of green housing residents, addressing the existing debate in the literature on the actual impacts of green buildings.

Another important strand of continued research is to better measure the environmental factors scored in this study. For example, the survey results analyzed in this paper unexpectedly showed a negative correlation between housing knowledge and general environmental knowledge. This relationship should be explored further and build on prior research explaining the wide variety of ways to measure environmental knowledge. Continued research on PEB is also needed, especially an understanding of subcategories of PEB that are influenced by factors other than environmental identity. Based on this study's finding that income has an indirect effect on PEB, it is important to understand which behaviors are most influenced by income and which may be influenced by other demographic factors. This information will be useful in promoting environmental behaviors for all, taking into consideration which demographic groups may be more or less inclined to engage in the behavior already.

Finally, qualitative research is necessary to discover what aspects of green housing are most salient to residents. In this study, respondents from both affordable and market-rate housing indicated that they saw themselves as the type of person who lives in green housing based on given definition that assumed residents were already aware of their building's environmental status. A qualitative analysis of residents' experiences with green housing would allow for researchers to draw out the knowledge and meanings residents have of their homes in a way that makes fewer assumptions and allows for more flexibility than a close-ended survey. Such analysis is especially necessary for residents of affordable housing since multiple residents told me that their building was not green, citing poor indoor air quality and other complaints with the building.

## CONCLUSION

On November 1, 2018, a few dozen realtors and one Tufts University student stood on a street corner in Roxbury, MA and looked up at a row house, the first energy positive building in the City of Boston. The realtors had come from all over the country for a national conference and were spending the morning on a tour of green housing in the city. The Tufts student, well, I was interested in studying the relationship between environmental identities and behaviors for residents of green housing and was invited to join the tour.

The tour leaders — sustainability professionals from the National Association of REALTORS® and the Boston Planning and Development Association — briefly touted the townhouses' features to an engaged crowd, and then introduced a resident to explain more. This resident and his family, said a tour leader, are a highly sustainable family for a highly sustainable home.

The resident chuckled at the kind introduction and explained that it was true: he told us how he can track the energy produced by the solar panels on his roof and the energy used by his house, and that he had changed his behavior to reduce those numbers. He explained his increased awareness of the environmental impacts of commuting, now that he lives very close to public transportation options. He even mentioned the benefits of having large (and extremely well-insulated) windows that look out over a neighborhood park, and that the mere sight of nature has increased his connection with environmentalism.

As my research shows, not every resident of green housing is as environmentally motivated as this resident is. But perhaps that is okay: here I was, surrounded by housing industry professionals who came from around the country to learn about increased

environmentalism in buildings. At the end of the conference, these realtors took their newfound knowledge of sustainability back to every client of theirs across the United States and the tour leaders continued their work at with the City of Boston to promote environmentalism in other projects across the municipality. Not everyone is destined to become a member of a highly sustainable family in a highly sustainable home, but perhaps collectively we can create highly sustainable homes for a highly sustainable world.

## APPENDIX A: Survey

### Residents' Experiences with Green Housing

**Principal Investigator: Liora Silkes, Tufts University**
**Faculty Advisor: Dr. Paul Joseph, Tufts University Department of Sociology**
**Phone: 206-548-6827 Email: liora.silkes@tufts.edu**

Hi, my name is Liora Silkes and thank you for your interest in my research. I am a senior at Tufts in the Sociology Department and am inviting you to complete a survey. Please find below information about this research for you to carefully consider when deciding about whether or not to participate. Completing the survey will take about five minutes. Participation is entirely voluntary, and if you participate, you can choose to not answer any question on the survey or stop the survey at any time. Your decision whether to participate will not affect your relationship with your property manager or tenant organization. If you withdraw from the study, the questions you answered before withdrawing may be included in the aggregated data.

**What is this study about?** I am studying how environmental identity and behavior are influenced by green housing and how those influences vary across income brackets. The survey consists of questions along these lines, focused on what you think about your housing and your relationship to the environment.

**What will you do to protect my privacy?** The results of the study may be published. We will take measures to protect your privacy and confidentiality such as never collecting your name. All survey results will be stored securely and only accessible to those listing in the following paragraph.

Individuals and organizations responsible for conducting or monitoring this research may be permitted access to and inspect the research records. This includes Tufts Social, Behavioral & Educational Research Institutional Review Board (Tufts SBER IRB) and Tufts faculty from the sociology and environmental studies departments. The de-identified, aggregated data may also be shared with your property manager or tenant organization for the purpose of improving your and future residents' experience with living in green housing. If you have questions about your rights as a research subject, please contact Tufts Social, Behavioral, and Educational Research IRB at 617-627-8804.

**What are the risks and benefits associated with this research?** There are no risks greater than those associated with everyday life in this study. There may be no personal benefit from your participation, but the knowledge received from this study may help further understanding of environmentalism and green housing.

You will not receive any compensation for participating in this research.

If you have any questions about my research, please contact me at Liora.Silkes@tufts.edu or 206-548-6827.

**By filling out this survey, I confirm that the purpose of the research, the study procedures, the possible risks and discomforts as well as benefits have been explained to me, and that I agree to participate in the study.**

Name of residential building:

_____

What is your gender?

_____

What is your age?

- ○ 18-24
- ○ 25-44
- ○ 45-64
- ○ 65 and over
- ○ Prefer not to say

How long have you lived in your current residence?

- ○ less than 1 year
- ○ 1-3 years
- ○ 4-6 years
- ○ 7+ years

How many adults (including you) live in your household?

- ○ 1
- ○ 2
- ○ 3
- ○ 4 or more

What is the highest degree or level of school you have completed? (If you're currently enrolled in school, please indicate the highest degree you have received.)

- ○ Less than a high school diploma
- ○ High school degree or equivalent (e.g. GED)
- ○ Some college, no degree
- ○ Associate degree (e.g. AA, AS)
- ○ Bachelor's degree (e.g. BA, BS)
- ○ Postgraduate degree
- ○ Prefer not to say

What is your household's income?

- ○ Less than $20,000
- ○ $20,000-$34,999
- ○ $35,000-$49,999
- ○ $50,000-$74,999
- ○ $75,000-$99,999
- ○ $100,000-$129,999
- ○ Over $130,000
- ○ Don't know/Prefer not to say

Please indicate your agreement with the following statements about environmentalism.

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| I think of myself as an environmentally friendly person | ○ | ○ | ○ | ○ | ○ |
| I think of myself as someone who is very concerned with environmental issues | ○ | ○ | ○ | ○ | ○ |
| I would be embarrassed to be seen as having an environmentally friendly lifestyle | ○ | ○ | ○ | ○ | ○ |
| I would NOT want my family or friends to think of me as someone who is concerned about environmental issues | ○ | ○ | ○ | ○ | ○ |

How often do you take the following actions?

| | Always | Often | Sometimes | Never |
|---|---|---|---|---|
| Walk, cycle, or take public transit for trips under 3 miles | ○ | ○ | ○ | ○ |
| Recycle batteries and electronics | ○ | ○ | ○ | ○ |
| Reuse/repair items instead of throwing them away | ○ | ○ | ○ | ○ |
| Talk with friends about environmental issues | ○ | ○ | ○ | ○ |
| Write to congress about environmental issues | ○ | ○ | ○ | ○ |
| Take part in environmental protests | ○ | ○ | ○ | ○ |
| Buy second-hand clothing | ○ | ○ | ○ | ○ |

Please check if the following statements are true or false.

Climate scientists believe that human-caused global warming will result in flooding of many coastal regions.

- ○ True
- ○ False

Climate scientists believe that nuclear power generation contributes to global warming.

- ○ True
- ○ False

Climate scientists believe that globally averaged surface air temperatures were higher for the first decade of the twenty-first century (2000-2009) than for the last decade of the twentieth century (1990-1999).

- ○ True
- ○ False

Climate scientists believe that human-caused global warming will increase the risk of skin cancer in human beings.

- ○ True
- ○ False

Climate scientists believe that the increase of atmospheric carbon dioxide associated with the burning of fossil fuels will reduce photosynthesis by plants.

- ○ True
- ○ False

Please indicate your agreement with the following questions about green housing. Green housing is defined as residential buildings designed to efficiently use resources such as water, energy, and building materials, reducing the environmental impact of the building.

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| Living in green housing is a part of who I am | ○ | ○ | ○ | ○ | ○ |
| I am the type of person who lives in green housing | ○ | ○ | ○ | ○ | ○ |
| I see myself as someone who lives in green housing | ○ | ○ | ○ | ○ | ○ |

Which of these factors influenced your decision to live in your current residence? Please rank the following options starting with 1 (most influential). If one of the listed options was not part of your decision at all, do not rank it.

_____ Distance from work/school

_____ Distance from family/friends

_____ Sustainable building features

_____ Housing cost

_____ Neighborhood features (public transportation, cultural centers, etc.)

_____ Other: _____

Check any of the following the green features you know are present in your building.

_____ Low-flow toilets and showers

_____ Energy-efficient kitchen appliances

_____ Constructed from reused materials

_____ Low-emissions paint and carpets

_____ Energy-efficient ventilation

_____ Energy-efficient insulation

_____ Other: _____

How often do you take the following actions?

| | Always | Often | Sometimes | Never |
|---|---|---|---|---|
| Buy in-season, local, or organic foods | ○ | ○ | ○ | ○ |
| Turn off lights when leaving a room | ○ | ○ | ○ | ○ |
| Recycle paper, plastic, and glass | ○ | ○ | ○ | ○ |
| Buy green cleaning products | ○ | ○ | ○ | ○ |
| Take short showers (less than 5 minutes) | ○ | ○ | ○ | ○ |
| Compost | ○ | ○ | ○ | ○ |

My knowledge of sustainable building features has _____ since living here.

- ○ Increased
- ○ Decreased
- ○ Stayed the same

My interest in environmentalism has _____ since living here.

- ○ Increased
- ○ Decreased
- ○ Stayed the same

My tendency to take pro-environmental actions such as those listed in previous questions has _____ since living here.

- ○ Increased
- ○ Decreased
- ○ Stayed the same

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