LEVERAGING ORGANIZATIONAL DYNAMICS IN BUILDINGS

TO CHANGE BEHAVIOR

by

ELIZABETH L. HEWITT

A Dissertation submitted to the

Graduate School-New Brunswick

Rutgers, The State University of New Jersey

In partial fulfillment of the requirements

For the degree of

Doctor of Philosophy

Graduate Program in Planning and Public Policy

Written under the direction of

Clinton J. Andrews

And approved by

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New Brunswick, New Jersey

October, 2015

ABSTRACT OF THE DISSERTATION

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By ELIZABETH L. HEWITT

Dissertation Director:

Clinton J. Andrews

Buildings may be stationary, but they are not static; they are dynamic and active collectives of agents and actors, and play an important cultural and social role in shaping norms and influencing outcomes in the built environment. This research develops and applies a unique framework that conceptualizes the urban multifamily residential building as an organization, and seeks to use this lens to better understand the role of organizational characteristics in influencing energy efficiency in buildings.

This work finds that an organizational analogy is a fruitful approach for understanding buildings, and that buildings in many ways can and do function successfully as organizations. In particular, eight organizational characteristics are explored here that extend well to buildings. These eight organizational characteristics are also explored more deeply to support an argument that some buildings have an organizational advantage that well positions them to undertake energy efficiency initiatives.

One organizational characteristic – the ownership type of the building – is determined to be particularly important in driving energy outcomes in multifamily buildings in New York City. In particular, it was found that cooperative buildings in the New York City housing market consume less energy citywide than other types of

multifamily properties, holding all else equal. Conversely, it was also found that rental buildings tend to consume more energy citywide. Subsequent qualitative case study work in a small Brooklyn cooperative building offers a deeper understanding of organizational decentralization and its role in driving decision-making and outcomes in the building. Additional comparative work in two rental properties – one high-income and one low-income – adds additional context and understanding to economic considerations such as the influence of income in overriding centralized efforts to operate the building efficiently.

Ultimately, this research develops an analogy of buildings-as-organizations – a conceptual framework – to better understand tangible built space. It posits that all buildings can function as organizations, and extends this framework to the urban multifamily building to advance knowledge of energy efficiency.

ACKNOWLEDGEMENTS

I would like to express my deep gratitude and appreciation to my dissertation committee, Professors Clinton J. Andrews, Joseph J. Seneca, Rachael Shwom, and Richard E. Wener. They have all offered input and expertise in ways that I could not have anticipated as I began this process, and I am grateful for their knowledge and willingness to share their time with me. A special thanks to my dissertation chair, Clinton Andrews, whose guidance and mentorship over the past five years throughout every stage of my doctoral process has had a monumental impact on my career development.

Many thanks to the colleagues and friends I have had the honor of working with prior to and during the completion of this work, including the team at the Rutgers Center for Green Building, especially Jennifer Senick, MaryAnn Sorensen Allacci, and Deborah Plotnick. I am thankful for their support and mentorship, and am grateful for the opportunity to work on many important and worthwhile projects with them over the past few years. Thanks also to my many former and current urban planning colleagues and friends who are undertaking great work and continue to be a wealth of inspiration.

I am very grateful to all of the individuals who offered their time as study subjects for interviews, site visits, and surveys for this research. I also gratefully acknowledge financial support from the National Science Foundation IGERT program. Special thanks to Professor Eric Lam and Dr. Linda Anthony for their work in managing the IGERT program and making it a rich and worthwhile experience for Trainees.

This dissertation is dedicated to my husband Eric Olivas, my mother Diane Hewitt, and my brothers Eric and Matthew Hewitt. Thank you for a lifetime of support.

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CHAPTER 1: INTRODUCTION

This research explores the hypothesis that urban multifamily buildings can be conceptualized as organizations, and that this approach may be helpful in motivating and understanding energy efficiency within the building. More specifically, it begins with the premise that all buildings are organizations, and from that premise it asks: What organizational criteria become relevant when extending an organizational approach to buildings, what organizational criteria contribute to energy efficiency engagement or action in the building, and how can organizational characteristics in buildings be empirically studied? This work looks specifically at themes of centralization and decentralization, the role of organizational members, and the extent of social relationships formed among members through the lens of buildings, and views the urban multifamily residential building as the physical link between these themes and potential energy efficiency. Although some prior work has explored the social role of the building, no work on organizations has been applied in a residential context. The approach in this work of linking organizations and buildings is novel, and contributes to our understanding of occupant behavior and the potential for collective action in residential buildings.

FRAMEWORK FOR RESEARCH

The Role of the Built Environment

Buildings are such a part of our lives that they are in many ways invisible – the unnoticed backdrop to the meaningful as well as the mundane. The overwhelming majority of activities that we undertake in daily life occur within buildings. The structures of the built environment shelter us while we sleep, provide places to work and eat, house our leisure and social needs, and give us space in which to play, argue, learn, create, and live. Much of the time, this "space" is mostly ignored as we undertake these activities.

Space, however, is social (Hall, 1990; Hillier, 1998; Sommer, 2008). As such, buildings are more than just physical structures that house our daily lives. They are agglomerations of occupants, activities, flows, social norms, power dynamics, and agency. They represent systems of intertwined influences and nested scales. They may be stationary, but they are not static; they are dynamic and active collectives of agents and actors.

It is widely known by environmental psychologists, architects and others that the built environment – through its tangible physical form – influences many of our daily actions and behaviors (Barker, 1968; Bechtel, 1997; Wicker, 1984). It achieves this through the layout of spaces, locations of switches, installation of devices and technologies, selection of materials used, and other design decisions made well before individuals occupy spaces. Some researchers examine the many ways that built form evokes *affective* responses in inhabitants (Kraftl & Adey, 2008). But the impact of the built environment goes beyond that; the buildings we inhabit on a daily basis – our homes, offices, stores and restaurants – are more than just material structures that impact inhabitants; they are reflective of our less tangible cultural and social world. As Davis

(2000) notes, “On the one hand, buildings exist as stand-alone artifacts, and on the other, they are artifacts that express the deep meanings, aspirations, and social order of a culture. Like the building culture that produces them, they are at the same time autonomous and interdependent with the culture at large” (p. 95). They are thus embedded with our societal and cultural preferences, aesthetic ideals, norms, trends, and power dynamics. It is clear, then, that although a building’s physical influence is bounded by its structure, its subjective influence reaches beyond the building.

Knox (1991) argues, “The built environment is both a product of, and the mediator between, social relations” (p. 182). Charney (2007) illustrates this in an exploration of the way the London skyline is being transformed from mostly low-rise historic buildings to new, status-symbol high-rises, despite opposition from community groups. This is due in part to a discourse about what makes a “world class city,” which has been given legitimacy by the Mayor of London, an individual in a position of power (Charney, 2007). Through the narrative used about famous architects and symbolic buildings, the Mayor has ascribed value and legitimacy to a particular type of built environment (Charney, 2007). The goal here is not to determine if this is good or bad, but only to make the point that the resulting shape and form of London will have impacts on street life, how people interact with buildings and one another, and the many ways people give meaning to the city they call home. The rhetoric about what types of buildings are important and why is materially reproduced in our built form.

This is true of social constructs such as fear as well. Low (2001) argues that the physical structures of gated communities (such as gates, walls, and other physical barriers to separate space) serve to legitimize socially constructed ideas about race, class, fear and separation. She explains, "Gated communities respond to middle-class and upper-middle-class individuals' desire for community and intimacy and facilitate avoidance, separation, and surveillance. They bring individual preferences, social forces, and the physical environment together in an architectural reality and cultural metaphor" (p. 48). Although New York City's density makes separation difficult, Low relates the 24-hour doorman presence in luxury residential buildings to this same concept.

These explorations of the social and cultural role of buildings lend support to the argument here that buildings are important for more than just shelter; they create and enforce norms, and have the potential to drive social dynamics. It makes sense then to approach buildings as both physical objects that bring groups of people together under a single roof and aggregators of opinions, preferences, and ideas.

Built form creates physical space, but it also creates place. What is place? Definitions vary. Most describe place as a sense of awareness of the physical space, and an understanding of one's being in that particular space. Place can also foster identifiable and tangible bonds between occupants and their physical spaces, attributes and surroundings (Manzo & Devine-Wright, 2013). The field of place attachment is well studied. As articulated by Kemsley & Platt (2012):

> Whether as layperson or architect, we learn about the nature of architecture from our personal experience of place – that gut reaction to a sense of being in a physical 'somewhere' at a particular 'sometime.' That sensation of place is on the continuum of containment or openness. But in these different conditions, there is a heightened awareness of *self;* an experience of the environment communicated through our senses and informed by our intellect. We are more aware of *ourselves* as well as of the place that has moved us in such a way (p. 28).

More recent work has begun to explore the role of place attachment in driving behavioral outcomes. Carrus, Scopelliti, Fornara, Bonnes, & Bonaiuto (2013) offer empirical evidence to support the premise that pro-environmental behavior can be linked to place attachment. Devine-Wright (2013), explores the shifting dynamics of place attachment in responses to climate change impacts. Although more empirical work is needed in this area, these findings help highlight the impact place attachment can have on individuals beyond just an affective or emotional level; this work also supports further exploration of the role of buildings in fostering both place attachment and behavior change.

Buildings as Organizations

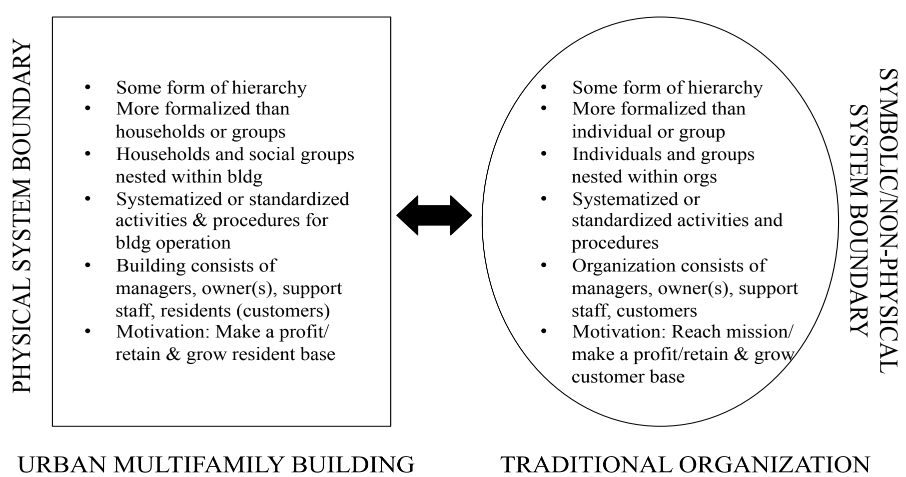
The framework for this research presents the analogy that buildings are organizations. It does so in order better understand some of the processes and actors within buildings that act in ways that parallel organizations. It is important to offer a rationale here for why it may be fruitful to approach buildings in this way, and for why it makes sense to view buildings as the unit of analysis, and not individual households or individual residents (which are also important scales).

Defining Organizations & Extending to Buildings

Kleindorfer, Kunreuther, & Schoemaker (1993) explain that it may be difficult to identify the boundary between groups and organizations, but that formal organizations typically have distinct characteristics, including a hierarchical structure, procedures that have been standardized or systematized, a larger size, and more complex activities. They acknowledge that individuals and groups are nested within organizations.

Multi-family residential buildings typically have all of these traits. They have some form of hierarchy that helps determine how the building is managed and operated, be it a large management company, a small cooperative board, or an individual building manager; they typically require the existence of and interaction between multiple individuals at a variety of scales in order to function and exist within a real estate market, including residents (or customers), managers, maintenance staff, concierge and resident support staff, and others; and the operation of the building, regardless of the building's size, has been standardized or systematized to some extent (for example, common area lights are on between the hours of 7pm and 7am, packages are left with the doorman or in a shared storage room, a designated individual ensures that recycling procedures are followed on city collection days, etc.). All of these activities and characteristics point to shared traits between buildings and organizations.

Figure 1.1 BUILDINGS AS ORGANIZATIONS



Buildings have an additional unique advantage as an organization: They offer a physical – and not just symbolic or social – structure to bound the organization, making the relationships and interactions within its walls all the more coherent and visible.

Behavior and decision-making within organizations is ultimately an exploration of the interrelation between agency and structure within firms (Andrews, 2008). In the case of buildings, that structure is partly physical. See Figure 1.1. for an illustration of the relationship between buildings and organizations.

Systems thinking, which is an approach used by some to understand organizations (Senge, 2010; Teixeira & Werther, 2013), spans both the engineering and natural sciences disciplines, and is also extendable to buildings. A building can easily be conceptualized as a system, with flows of resources and waste in and out of the system, positive and negative feedbacks occurring within the system, and a number of actors influencing operation of the system. Teixeira & Werther (2013) conceptualize an organization as an organism. In this framework, organizations need to adapt and remain flexible in order to survive and thrive. Buildings – as organizations and systems – must do this as well; they rely on members of the organization (building owners, operators, managers, and residents) to construct, manage and operate buildings in innovative and adaptive ways to ensure efficiency and resiliency for the life of the structure.

Rationale for the Building Scale

Although an individual actor approach is important and necessary, this work intends to take an organizational stance to analysis, as described above and, as such, it aligns with the thinking of Senge (2010). According to Senge, all organizations are systems. Taking a systems approach, Senge argues that:

> In mastering systems thinking, we give up the assumption that there is an individual, or an individual agent, responsible. The feedback perspective suggests that *everyone shares responsibility for problems generated by a system.* That doesn't necessarily imply that everyone involved can exert equal leverage in changing the system. But it does imply that the search for scapegoats – a

> particularly alluring pastime in individualistic cultures such as ours in the United States – is a blind alley (p.85).

Thus, taking the building as the unit of analysis proves appropriate for a buildings-as-organizations approach.

Further, there is evidence that organizations can potentially influence energy consumption and efficiency. Prindle & Finlinson (2011) note, “In the U.S. today, organizations are becoming larger and more diverse, so attempting to understand and control energy use based on building type or end-use is less important than understanding how organizations can measure and manage performance across a wide range of building types and end uses” (p. 307).

Schelly, Cross, Franzen, Hall, & Reeve (2011) explored energy efficiency measures in a school district case study and highlight the intertwined and dynamic roles of organizational culture and individual behavior. In particular, the researchers note the role of charismatic leadership and comparative feedback (stimulating competition) in changing behavior at individual schools. Similarly, Janda (2014) frames energy efficiency opportunities as an intersection of “organizational factors, occupant behavior and technology adoption” (p. 2). She draws on the work of Axon, Bright, Dixon, Janda, & Kolokotroni (2012), who offer a framework for understanding commercial energy efficiency by developing the concept of “building communities.” I believe this concept can be useful here. Axon et al. view buildings as a scale distinct from both organizations and individuals – an appropriate framing for multi-tenanted commercial buildings. In the case of multi-family residential buildings, perhaps the building and the organization can be one and the same.

Limitations to this Approach

It is important to also acknowledge limitations to conceptualizing buildings as organizations. First, this framework should be viewed as a helpful analogy to better understand buildings, but not as a literal interpretation of the buildings sector. Buildings are ultimately physical manifestations of the organizational work of many industries and players – architecture, engineering, real estate, etc. – and these interdisciplinary industries have a host of organizations nested within them. Extending the lens of organizations to buildings as an analogy is a helpful tool for better understanding the relationships between these various disciplines and actors that exert influence on the building, but ultimately the building is just one outcome of the work of many organizational actions. A similar approach can be seen in the field of industrial ecology, which uses the analogy of natural ecosystems to better understand industrial processes. Although industrial production will never perfectly mimic nature, the ecosystem analogy gives industry a new lens with which to view itself. The framework used here offers a similar approach for buildings.

Next, according to Scott (1991), organizations do not just influence a wider societal context, but are actors in and of themselves. We have to employ caution in extending this directly to buildings, because such a line of thinking would imply that the physical built inanimate structure of the building has agency; it is important to acknowledge and remember that the "agency" in buildings is always derived from human actors involved with the building in some way. The building-as-organization is a fruitful analogy, but humans are still driving decision-making. One caveat to this disclaimer is that as buildings become "smarter" much of their technology is becoming automated leading to instances where some buildings are indeed operating themselves (although humans still initially programmed the automation technology in most cases).

Also, the framework for buildings as conceptualized here is only applicable in the context of urban multifamily buildings in large cities. It is important to acknowledge that this framing of buildings would likely not be extendable to single-family homes, for instance, or even small suburban apartment complexes. As such, there are some limitations in extending this work to other contexts.

The Urban Multifamily Building

This work focuses specifically on multifamily buildings located in dense urban areas. The urban multifamily building – as opposed to suburban low-rise multifamily units or single-family attached or detached homes – is unique within the built environment for two reasons. First, residential spaces foster a different – and more personal and intimate – type of place attachment than other buildings and spaces. Although experts in place attachment have found that occupants can form attachment to many types of spaces, including workplaces, recreation areas, and others, they acknowledge the bond that individuals form with their homes is stronger and more intimate, and homes are a form of "primary territory" (Brown, 1987; Manzo & Devine-Wright, 2013). Second, within the category of residential spaces, urban multifamily buildings offer a unique context and provide very different forms of social interaction than single-family homes. More and more U.S. residents now reside in cities, and within cities, the multifamily building is a ubiquitous choice. As of the 2010 U.S. Census, 25.4% of U.S. households reside in multifamily owner- or renter-occupied housing units (defined as 2 or more units in the building) (U.S. Census Bureau, n.d.).

Occupants of urban multifamily buildings have different interactions with neighbors and a different lifestyle than their suburban counterparts. It is these characteristics that, I argue, contribute to the organizational carryover between buildings and organizations. Children residing in multifamily buildings, for instance, spend Halloween trick-or-treating not outside on the streets by visiting neighboring apartment buildings, but within the corridors and floors of their own building. The hallways, lobbies, stairwells and elevators become de facto street corners, front stoops, and sidewalks of sorts, and sites for public interaction, meetings, friendship, animosity, conversation, and play, all contained within the four walls of the multifamily building. It is these interactions that contribute to shared social factors between buildings and organizations.

Buildings and Energy

Beyond the social aspect of buildings, there is good reason to care about building operations and, as such, the behaviors and consumption patterns occurring within them. Most buildings are still powered by finite fossil fuel sources, and contribute to CO_2 emissions. Emissions from building operations comprise approximately 40% of total annual CO_2 emissions in the U.S., and nearly 80% in New York City, where density is higher. Within building operations, the residential sector is a particularly important area to focus on. The residential sector accounted for 1,105 million metric tons of CO_2 emissions in the U.S. in 2013, an increase of 141 million metric tons from 1990 (U.S. Energy Information Administration, 2014). Reducing energy consumption in buildings is crucial to meeting any substantial carbon reduction goals in coming decades.

Energy is not easy to understand and research, however, and it presents unique methodological challenges. First, it is unseen and embedded in our daily lives, making it difficult to conceptualize and measure. As Guy and Shove (2000) explain, “To know that one has saved energy, one has to have some way of rendering it visible” (p. 36). Although this can be remedied by collecting kilowatt-hour (kWh) electricity data, which offers researchers a quantitative metric of household consumption, this is not a perfect solution; energy consumption as a totality – including the many ways we consume it beyond electricity usage – is not straightforward, making its measurement and data collection difficult in practice. This leads to basic logistical issues in forming and executing research proposals. Researchers need to be clear about what, precisely, they are attempting to measure and study, knowing that by focusing in on one area they may be forced to exclude another area, even if both exert influence on energy consumption. Further, energy is consumed as a good or service by individuals, firms or households, yet is inherently broad in its flow through our lives, encompassing much larger scales than individuals or households, which makes it difficult to determine the appropriate level of analysis. Finally, it is consumed not necessarily as an end product in and of itself, but instead as a means of achieving other goals, such as warmth, comfort or transportation, making it difficult to understand the real motivations behind behavior (Cayla, Maizi, & Marchand, 2011). Thus, it becomes difficult for the researcher to focus on changing behavior, because the behavioral hierarchy does not make it easy to target energy use directly. This is not the case with all environmental behaviors, making it a challenge unique to energy. For instance, recycling behavior requires a concrete decision to recycle, and can be measured and directly observed; but there is a disconnect between the consumption of energy and its end use.

This disconnect also highlights the host of economic issues that are necessary to grapple with when researching energy in a multifamily residential context. For instance, most shared amenities in multifamily buildings – such as gyms, lobbies, elevators, and recreation rooms – act as public goods, creating misaligned incentives to consume, and encouraging “free rider” behavior (Callan & Thomas, 2009; Hardin, 1976; Olsen, 1969; Ostrom, 1994, 2000). Olsen (1969) explains that individuals who belong to groups (such as those with the collective privilege of the using shared space in multifamily buildings, for instance) prefer to maximize their own best interest and will not voluntarily choose to work collectively to achieve group goals; they would prefer instead for others in the group to achieve the desired benefits, knowing their membership in the group will afford them these benefits whether they contributed to them or not. Similarly, misalignments in multifamily residential properties can occur not just in resource consumption in public spaces, but also within individual apartment units, as not all multifamily properties are sub-metered (meaning individual residents often receive no price signal in the form of a monthly electricity bill), and renters in particular have little incentive to make retrofits to their apartment if they do not own the unit. It has also been found that individuals tend to have inappropriately high personal discount rates when making decisions about potential future savings from investments in energy efficiency purchases (Ansar & Sparks, 2009; Jaffe & Stavins, 1994; Thompson, 1997). The ‘energy paradox,’ according to Jaffe and Stavins, illustrates an unwillingness to invest in cost-effective equipment and upgrades that could greatly decrease energy consumption and lower costs for the consumer, a seemingly backwards decision-making logic. But although some may point to consumer irrationality to explain the faulty individual discount rate, Awerbuch & Deehan (1995) argue that consumers often make *personally* rational decisions, which incorporate difficult-to-quantify components that traditional financial calculations do not include, such as transaction costs that may create demands on the consumer's time and energy, and real differences in preference choices for alternatives, all of which they say consumers implicitly give value to when weighing alternatives. Thus, individual building occupants are complex and heterogeneous.

Income and response to pricing are two such areas of heterogeneity among building occupants, and energy bills represent a larger fraction of monthly income for low-income residents than for high-income residents. As a result, some household energy consumption is income elastic and highly determined by affordability, not lifestyle or environmental values (Cayla et al., 2011; Jamil & Ahmad, 2011; Wilson, Tyedmers, & Spinney, 2013). In addition, the rebound effect, in which efficiency gains due to advances in technology are offset by higher rates of consumption, can become problematic in households at all income levels.

Thus, energy consumption in multifamily properties comes along with a host of challenges, both social and economic, and should be approached through a number of lenses, at a variety of scales, and from the standpoint of various actors; this research is one attempt at looking at energy use in new ways by using an organizational lens to better understand the relationships between different scales of actors and how they are linked within a building unit.

A Framework for this Research

This research begins with the premise that buildings are organizations. As such, an aim of this research is to investigate organizational characteristics that are translatable to the building unit, and which of these characteristics play a role in encouraging energy efficiency engagement in the urban multifamily building. It seeks to better understand the extent to which the building – as the unit of analysis – is a community or social unit nested within the larger neighborhood or city context, and how the presence or strength of certain organizational characteristics contribute to or detract from this.

This dissertation will unpack this issue by studying multiple building types. It views the building as the primary unit of analysis, but acknowledges that although the building is physically bounded by its walls and built structure, its less tangible social and cultural boundaries will be more fluid. Similar to organizations, in which debates exist regarding the openness of the organizational system, this approach acknowledges that the building is not an island, but nested within its city block, street or neighborhood.

APPROACH & METHODOLOGY

Guiding Research Questions

Starting from the premise that all buildings are organizations, this work is focused around a set of nested research questions, beginning with a primary point of inquiry that asks:

- ***What criteria are important in defining a building as an organization?***

This question is important because it provides a preliminary framework that then carries through the remainder of the research. The goal of this primary guiding research question is to parse out specific characteristics of organizations that are translatable to buildings, and develop a typology of buildings-as-organizations to help frame the rest of the research. Although organizational theorists and researchers have developed many studies to better understand organizational characteristics and functions, translating this to the building unit requires some modification and tailoring.

From this starting point, sub questions are explored that delve deeper into energy efficiency and the particulars of certain types of organizations. These nested questions are as follows:

a. Which building organizational types are more likely to engage in energy efficiency behavior?

This question attempts to connect the typology developed in the primary research question to the specific behavior area of energy efficiency engagement. It asks if specific organizational criteria – such as the organization's type, size, level of decentralization, and culture, among others – are indicative of energy efficiency engagement within the building. From this line of questioning that delves deeper into energy behavior, two additional sub-questions are then asked that aim to bridge empirical research with theoretical research questions. These questions ask:

b. Which building organizations show evidence of actually being more energy efficient?

This question starts with the premise that some characteristics are already understood to be important in an organization's willingness or ability to engage in energy efficiency behavior based on the framing of the prior question. Thus, it asks – can this be empirically proven? This question relies on a large building dataset to assess and analyze the role of some of the organizational factors previously identified to be drivers of energy efficiency engagement. This leads to the final nested research question, which asks:

c. ***What building types merit further study as organizations, and can organizational characteristics be studied empirically?***

Coming on the heels of nested sub-question "b," which identifies empirical characteristics of actual building-organizational types that appear to indicate an energy efficiency leaning, this question then asks how far these characteristics carry? It explores hypotheses about particular building types with the aim of using empirical fieldwork in specific buildings to identify if and how key organizational characteristics identified as important in the previous questions impacts an overall energy efficiency inclination.

Hypotheses

Buildings share many of the defining characteristics of organizations. They can be centralized or decentralized; fluid or rigidly managed; hierarchical or flat; transparent or obscure. However, existing work has focused primarily on the following two areas: organizational behavior in corporations or firms, and the social role of buildings through a sociological or design lens (not an organizational lens). This indicates a significant gap in an unexplored area – the intersection of organizational behavior, the social role of the built environment, and energy consumption, connected through the physical link of the building as the unit of analysis. Based on the research questions outlined previously, this research posits the following 5 hypotheses:

1. All buildings are organizations
2. Although all buildings are organizations, the presence or strength of some organizational characteristics in buildings give that building an organizational advantage that makes energy efficiency easier to spearhead, implement, manage, and maintain

3. Ownership type as an organizational characteristic plays a role in determining building energy consumption
4. Cooperative buildings are more decentralized; decentralization determines proximity, transparency, and level of perceived control
5. Rental buildings require centralization to be effective on collective efforts, but even in highly organized and centralized buildings, the individual agent will often drive action

See Table 1.1 for an overview of research questions and connected hypotheses as outlined above.

Table 1.1 Research Questions and Hypotheses

Research Questions	Hypotheses	Dependent Variable(s)	Independent Variable(s)	Data	Type of analysis	Chapter
1: What org criteria are important in defining a building as a particular type of organization?	**H1**: All buildings are organizations	Organizational type	Building characteristics	Literature, interviews & site visits	Qualitative	2
1a: Which of these building-as-organization types are more likely to engage in energy efficient behavior?	**H2**: Some organizational characteristics give a building an organizational advantage, making energy efficiency easier to implement	Score on organizational criteria; NYC 2013 EUI	Building-organizational characteristics	Literature, interviews, site visits, and energy disclosure data	Qualitative	3
1b: Which of these organizational characteristics can be deemed important in actually lessening energy consumption?	**H3**: Ownership type determines energy use (owner occupied units consume less energy than rentals; within the owner segment, co-ops consume less energy than condos)	Less energy consumption than similar buildings	Actual building characteristics and new organizational variables of those buildings	NYC energy disclosure data, NYC PLUTO data, and new org variables	Quantitative	4
1c: Given outcomes from 1b, what building types merit further study as organizations, and can the specific organizational characteristics of centralization and decentralization be studied empricially?	**H4**: Co-ops are more decentralized; decentralization determines proximity, transparency, and locus of control	Analysis of proximity, transparency and locus of control based on survey findings	Co-op characteristics and building characteristics	Interviews, site visit and survey data from Building 5	Mixed methods -- case study of small co-op in Brooklyn	5
	H5: Rental buildings require centralizatiom to be effective on collective efforts (energy efficiency and other), but even in highly organized and centralized buildings, high income individuals with luxury amenities and apartments will often still consume more	Full building energy consumption (EUI), aggregate kWh consumption, individual household kWh consumption	Household income, importance of avoiding cost and expense at home, indicators of building centralization	Surveys and interviews from Building 2 and Building 4	Mixed methods -- qualitative analysis of interviews, some quantitative analysis of electricity data and survey data	6

Methodology

In order to examine the themes and issues raised in the research questions above, this research undertakes fieldwork in ten New York City multi-family residential buildings across a variety of sizes, types, and characteristics. All buildings studied are listed in summary Table 1.2, and explained in more detail later in this section.

The project utilized a grounded theory approach to data collection and analysis; initial fieldwork led to a refining of research questions and hypotheses, which was followed by more tailored fieldwork, which led to a further refining of research questions and hypotheses. This iterative process relied on the following data collection methods:

1. **Qualitative interviews:** Approximately 20 qualitative interviews were conducted over a 6-month period of time with individuals who are members of the residential building community in New York City. This included residents of rental buildings (13), residents of condominium buildings (1), residents of cooperative buildings and members of cooperative boards (2), building managers of both rental and owner-occupied units (2), and representatives from corporate owner and property management firms (2).

   Interviews were also conducted with 30 residents in two of the rental buildings (Building 2 and Building 4) in 2011-2012 as part of a National Science Foundation project administered by the Rutgers Center for Green Building of which I was a part. Interviews were conducted with 15 residents of Building 2 and 15 residents of Building 4.

2. **Secondary datasets**: This research made use of two large publicly available datasets about buildings for portions of this work. The first is New York City's Local Law 84 (LL84) energy disclosure dataset from 2013 (publicly released in November 2014). This dataset offers annual energy consumption data for over 12,000 residential and commercial properties over 50,000 SF in size located throughout the five boroughs. This research relies exclusively on the residential building portion of this dataset. Second, this work also used New York City's Primary Land Use Tax Lot Output (PLUTO) data, which gives information on ownership, zoning, and property taxes for all properties in New York City. Because the two datasets rely on the use of the same common building identifier, the two datasets were merged, such that information about high and low energy users would now be linked to information about ownership type and zoning. New organizational variables were also created for this dataset.

3. **Building investigations:** Ten residential buildings were investigated; this data collection included site visits to observe common space design and use, one or more qualitative interviews (described above), and the collection of energy consumption data where available (whole building energy use intensity (EUI) from disclosure data, individual household billing data, or both, depending on the building). A summary of the collected building data and a brief description of each building can be found in Table 1.2. Each building will also be described in turn in this section.

Table 1.2 Buildings Studied

Building	Type	Description	Neighborhood	Borough	Size	Age	Data	Energy Data Available?
1	Rental	Market rate	Upper west side	Manhattan	498 units	1986	Site visit, resident interview	Yes (whole bldg)
2	Rental	Luxury green	Battery Park City	Manhattan	293 units	2003	Site visits, resident interviews, management interview, full-building survey	Yes (whole bldg and all HHs)
3	Rental	Luxury green	West Chelsea	Manhattan	710 units	2014	Site visit, corporate interview	No
4	Rental	Affordable EnergyStar	South Bronx	Bronx	130 units	2009	Site visits, interviews, survey	Yes (whole bldg and partial HHs)
5	Coop	Market rate	Prospect Heights	Brooklyn	16 units	1909	Site visits, resident interviews, board member interviews, full-building survey	No
6	Rental	Luxury	Upper west side	Manhattan	207 units	1988	Site visit, resident interview	No
7	Rental	Rent stabilized	Upper east side	Manhattan	237 units	1902	Site visit, resident interview	Yes (whole bldg)
8	Condo	Luxury	Fort Greene	Brooklyn	108 units	2008	Resident interview	Yes (whole bldg)
9	Coop	Market rate	Ditmas Park	Brooklyn	189 units	1932	Resident interview	Yes (whole bldg)
10	Rental	Luxury green	Fort Greene	Brooklyn	369 units	2007	Resident interview	Yes (whole bldg)

***Note: Additional interviews were conducted with residents and managers of other buildings not listed above. No other data was collected for these buildings (and no energy data was available), so they are not listed here, but interview findings are included where applicable throughout the research.*

Building 1

Building 1 is a conventional (non-green) market-rate high-rise rental building located in Manhattan's Upper West Side neighborhood built in 1986. The building – South Park Tower – is located a short walk from the west side of Central Park, Columbus Circle, and Lincoln Center. The building contains 498 studio, one- and two-bedroom units, and is 51 stories tall. Although the property does not have centralized cooling and heating for apartments, each unit has an in-wall heater/air-conditioner unit. Residents do not need to rely on self-installed window air conditioning units, but apartments are sub-metered, so costs for the use of the heating or cooling during winter and summer months are reflected on residents' individual monthly electricity bills. A current apartment on the market is a 2-bedroom, 2-bath unit with an asking rent of $6,900 per month. The building is managed by the Brodsky Organization, which owns and manages approximately 80 buildings in various neighborhoods of New York City. This particular building offers a 24-hour doorman, fitness center, rooftop space, and pool. The total size of the property is just over 566,000 SF. The building sits adjacent to buildings housing dormitory space for Fordham University's Manhattan campus, and across the street from classroom and academic buildings, so the block is heavily populated with college students and has a lively urban campus feel. One resident was interviewed in this building, and the property was visited to view the lobby, apartment unit, pool, and other shared spaces.

Figure 1.2. Building 1

Building 2

Building 2 is a green luxury high-rise rental building located in Battery Park City in Lower Manhattan with 293 units built in 2003. It is approximately 30 stories, 350,000 SF, and houses a mix of studio, one, two, and three-bedroom units. It offers a centralized heating and cooling system. This property is rated LEED Platinum by the United States Green Building Council, indicating it has met certain requirements for materials, water conservation, energy use, and recycling. In order to earn its LEED Platinum rating the building had to meet minimum energy efficiency requirements by benchmarking energy use to demonstrate that the building performs at or better than the 69th percentile of similar buildings using national source energy data available in the Environmental Protection Agency's Portfolio Manager tool . It has façade-mounted solar panels and a roof array, as well as an on-site wastewater treatment plant. Approximately 700 people are residents of the building, and in addition to its green features, the building offers in-apartment washers and dryers, a shared roof garden, a fitness center, and a children's playroom. The asking rent for a 2-bedroom unit that is currently on the market is approximately $7,200/month. The management company, The Albanese Organization, owns and manages approximately 7 residential properties in New York City, two of which are located in the same neighborhood as Building 2. This particular building was part of a larger National Science Foundation research project undertaken by the Rutgers Center for Green Building in which the potential for self-sufficiency in urban green buildings was investigated. During the multiple years of the study, an immense amount of data was collected from the building and its residents, including survey and interview data, water and air quality data, electricity data, and occupancy data. This dissertation research relies on survey and interview data, along with electricity data.

Figure 1.3. Building 2

Building 3

Building 3 is a green rental high-rise building located in West Chelsea with approximately 710 units completed in 2014. It is one of many newly developed residential properties along the popular High Line park, which sits on former elevated rail tracks on Manhattan's west side, and is the largest building included in this study. It is 31 stories, and approximately 676,000 SF. The building is designed to attract a young clientele, with many social activities (such as resident happy hours), and shared spaces (such a fire pit) on-site in the building, and an aesthetic of bright colors and playful design features. It bills itself as "sustainable," but is not as energy efficient as Building 2. It is currently not LEED rated, but the developers list it as being "designed for LEED" and have branded it with the developer's own "Green Living Label." The developer and property manager is a large real estate developer that owns and manages residential properties across the country. Current studio apartments in the building begin at approximately $3,400 in monthly rent, and 1-bedroom units begin at approximately $4,100, putting the units at a slightly lower price-point than Buildings 1 and 2. A site visit was conducted, along with an in-depth interview with the corporate arm of the management company of the building. At the time of the site visit, Phase I of the building was fully occupied. Occupancy for the second phase of the building was expected to begin in 2015. The building participates in New York City's 80/20 program, which means that of the 710 units in the building, approximately 20 percent are set aside for low-income residents, with applicants chosen by lottery. A resident of an affordable studio apartment in the building pays approximately $545 in monthly rent.

Figure 1.4. Building 3

Building 4

Building 4 is an EnergyStar-certified low-income rental building in the South Bronx with 128 units built in 2009. The property is a 7-story elevator building with 150,000 total SF and over 6,000 SF of ground floor commercial space. Building 4 is not LEED certified, but at the time of its completion in 2009 it was the largest EnergyStar certified, multifamily, affordable high-rise residence in the United States. A number of conservation and energy efficiency features were incorporated into Building 4's design, including low flow faucets and showerheads, Energy Star fixtures and appliances, and energy-efficient windows. An energy efficient heating and ventilation system and insulation were incorporated in the building's construction, but the building does not have a centralized cooling system. Residents must rely on window air conditioners during summer months. Approximately 400 people occupy the building. It was constructed to serve some of the area's most vulnerable low-income residents. It was built and developed by a nonprofit housing organization called the Women's Housing and Economic Development Corporation (WHEDCO), and WHEDCO contracts with outside vendors to provide on-site staffing, maintenance, and property management. In addition to the 128 individual apartment units, the building also includes a shared outdoor courtyard, a roof garden, a laundry room, and a lobby. WHEDCO has tried to develop programming to engage residents around issues of healthy living.

Figure 1.5. Building 4

Building 5

Building 5 is a small, 4-story, walk-up, pre-war cooperative building located in Prospect Heights, Brooklyn with 16 units, built in the early 1900's. The building is masonry construction, and totals 13,385 SF. All of the units are two- and three-bedroom apartments. The property does not have a centralized heating and cooling system. Residents rely on window air conditioners during summer months, and building-wide steam heat during winter. The property was a rental building from its time of construction in the early 1900's until it underwent a cooperative conversion in the mid-1980's, at which time 4 original owners purchased 13 of the building's 16 total units. One of the original owners still sits on the cooperative board as the treasurer, and still owns the most shares of all residents of the building. Of the remaining three units that did not convert to cooperatives, two of the units remain rent-controlled affordable housing, and one unit is a market rate basement rental that the residents use to generate additional income for the property. In addition to the apartment units, the building has a shared backyard with a grill and seating, a basement with laundry room and shared storage, and a front garden. Residents often have social gatherings in the backyard. The neighborhood of Prospect Heights in Brooklyn is a rapidly changing area just a few blocks from Grand Army Plaza, the Brooklyn Botanic Garden, Brooklyn Museum of Art, and the northern entrance to Prospect Park. The area has been gentrifying in recent years as more young professionals move into this formerly low-income neighborhood. One two-bedroom unit that was purchased in 2011 for approximately $450,000 is currently under contract with a sale price of approximately $650,000. A full-building survey was conducted in Building 5, and 3 interviews were conducted with two different residents/board members.

Figure 1.6. Building 5

Building 6

Building 6 – Archstone – is a conventional (non-green) luxury rental high-rise building located on the Upper West Side of Manhattan close to Columbia University and one block west of Central Park. The property was built in 1988 and has 207 one, two, and three-bedroom units. It is 12 stories, with brick exterior, and approximately 315,000 SF. The building does not have a centralized ventilation system, but resident-controlled air-conditioning units are provided in each apartment. The building offers a fitness center, courtyard, shared rooftop, and top-floor playroom available for birthday parties and events. Two bedroom units currently available in the building are asking between $5,600 and $6,000 per month. The building is managed by Equity Residential, a large property management firm that manages residential communities in major metropolitan areas across the country, such as Key West, Washington D.C., Denver, Boston, and San Diego. They own or manage 29 buildings in New York City. One resident was interviewed in this building, and the property was visited to view the lobby, apartment unit, rooftop, and playroom.

Figure 1.7. Building 6

Building 7

Building 7 is a conventional (non-green) rent-stabilized rental property built in 1902 with 237 units spread across 6 buildings. This property is a six-story walk-up in a tenement-type structure located on the Upper East Side of Manhattan approximately two blocks from the East River. It is walking distance from the Manhattan entrance to the Roosevelt Island tramcar, the Fifty-Ninth Street (Queensborough) Bridge, and the FDR highway. The property houses one- and two-bedroom units, and is fairly standard in terms of amenities. There is no on-site doorman presence or front desk area, and the entryway of each building leads to a simple lobby with mailboxes and stairwells (no seating, lounge, or waiting area). Apartments use window air conditioning units during summer months, and rely on steam heat for winter months. There is a laundry facility around the corner that is associated with the building and usable by residents, but not accessible from inside the building. No shared roof or outdoor spaces exist, although there is a rear parking area in what would be a courtyard between the 6 buildings where residents can apply and pay for a monthly park spot. This area is only accessible via a locked gate in the middle of the southernmost block of the property. The ground floor of the building has frontage on First Avenue and is populated with retail, shops, and restaurants. The property is managed by Charles H. Greenthal & Co., a large New York-based brokerage and property management firm that manages 185 city properties. Although Greenthal manages many high-end, luxury properties, this particular property is rent-controlled and requires that potential residents submit an application and must typically be put on a wait list. The resident interviewed in this building has lived in her apartment for over 15 years, and pays approximately $1,100 for a 1-bedroom unit. Due to the affordable rents and difficult entry, most residents remain in the building for a long time.

Figure 1.8. Building 7

Building 8

Building 8 is a conventional (non-green) high-rise luxury condominium/rental property in Fort Greene, Brooklyn built in 2008. The Forte, designed by FXFOWLE, houses 108 residential units in 122,000 SF, and is 30 stories tall. It offers a fully centralized ventilation system for heating and cooling. The property offers a number of high-end amenities, including a full-time doorman and well-appointed lobby, a fitness center, and a shared roof-deck. It is located walking distance from the Brooklyn Academy of Music (BAM) theaters and cultural area, Fort Greene Park, and Atlantic

Terminal. A portion of the property was converted to rental units in 2010 after the developer was hit by the housing recession, so the property currently operates as a hybrid of half owner-occupied/half rental units. Current listings for 2BR units on the market in the building range from $950,000 to $1.4 million, but at the time of initial sale in 2009, most units in the building were sold for well under $1 million. Current rentals on the market are in approximately the $4,000/month range for 2-bedroom units. An condo owner resident was interviewed, and the property was visited to view lobby, shared spaces, roof deck, etc.

Figure 1.9. Building 8

Building 9

Building 9 is a conventional (non-green) mid-rise market-rate cooperative building located in Ditmas Park, Brooklyn. The property is a 6-story pre-war elevator building with 189 units in 220,000 SF built in 1932. The property is brick construction without a centralized ventilation system. Residents use window air conditioning units during summer months, and the building provides steam heat during winter. The building offers mid-range amenities such as elevators, a large, well-appointed lobby, a full-time doorman, laundry room in the building, and shared garden/courtyard space for residents. The apartments offer a number of unique pre-war design features such as arched doorways and detailed crown molding. Ditmas Park is a neighborhood in Brooklyn located south of Prospect Park known for its beautifully maintained and restored Victorian homes. The area is approximately a 30-minute subway ride from lower Manhattan. The property attracts young professionals, families, and first-time homebuyers. A current one-bedroom unit is on the market for $485,000.

Figure 1.10. Building 9

Building 10

Building 10 is a green luxury high-rise rental property located in Fort Greene, Brooklyn with 369 units. Similar to Building 8, the property is located walking distance from Atlantic Terminal, and the BAM cultural district. The property – called DKLB – was built in 2007 by Forest City Ratner Corporation and is LEED Silver certified. It is 36 stories and 335,000 SF. It offers a centralized ventilation system, low-VOC paints and finishes, well-insulated façade and low-E glazing, designs to maximize natural light, bike room storage, and Energy Star appliances in all apartments. In addition to the green features, the building offers amenities such as a 24-hour doorman, fitness center, valet parking, shared terrace, and residents' lounge with kitchen, library, billiards, and wifi. Current one-bedroom units on the market are asking between $3,100 and $3,500/month in rent. A two-bedroom unit on the market is asking $6,500/month in rent.

Figure 1.11. Building 10

Some of the buildings listed above were selected for more detailed analysis as case studies in later chapters based on the availability of certain data in each. Buildings 1, 2, 4, 7, 8, 9, and 10 were selected as mini-case study buildings for Chapter 3 because full-building energy use data was available for each from the City of New York. Building 5 was selected as a case study for Chapter 5 because it allowed for detailed study of a small cooperative building. Buildings 2 and 4 were selected as case studies for Chapter 6 because they allowed for a comparative exploration of two green rental properties with very different resident demographics (one high-income and one low-income).

4. **Survey data:** A survey was conducted in Building 5 to better understand specific outcomes and characteristics that I hypothesize are unique to co-ops. The survey asked questions about the respondents' building, social interactions, level of knowledge about the co-op board, and amount of influence they feel they have on the decision-making within the building. The survey was administered to all 16 households in Building 5 in January 2015 and all adults in the building were asked to complete the survey. Residents were offered the chance to be entered into a drawing for a $50 Amazon gift card for completing the survey, and 12 responses were received. The full survey instrument can be found in Appendix B.

   Surveys were also conducted building-wide in Building 2 and Building 4 in 2011-2012 as part of a National Science Foundation project administered by the Rutgers Center for Green Building of which I was a part. This data is used in Chapter 6 to explore specific energy outcomes and characteristics that I hypothesize are unique to rental buildings; in particular, this data is used to examine the role of income and socioeconomic status.

5. **Energy data:** In addition to whole-building energy data, which was available for some of the buildings from New York City's annual disclosure data (explained above), energy data for individual household electricity consumption data was made available for all apartments in Building 2 and a portion of apartments in Building 4 as part of the National Science Foundation project mentioned above. This data is also used in the Chapter 6 case study.

RELEVANCE

As a research topic, this particular project offers a number of potential contributions to the field. First, the project will apply the framework of organizations to an under-explored area of study: The multi-family urban residential building. Most organizational literature explains the behavior of individuals as members of firms, thereby nesting our understanding of this group/organizational behavior within corporate structure, profit motivations, and production and supply decisions. While some of these economic concepts are relevant here, I suspect that the organizational literature can be extended in new ways in a residential context, and this project will allow for that exploration. For instance, the supply chain is an important element in a firm's efforts to minimize costs and maximize profits (Shepherd & Shepherd, 2003). However, in a residential built-environment context, there is little distinction between consumers and producers, which shifts the supply chain perspective considerably.

Next, this approach is important in that it acknowledges the potential synergies between scales (individual, household, and building levels) and will explore if the interactions between scales can influence behavior. Exploring these nested scales empirically can add to knowledge about what works – and what doesn't – in changing occupant behavior. We know that occupant behavior is important. As Blumstein, Goldstone, & Lutzenhiser (2000) note, "While the residential construction industry is continuously focused on innovation in materials and design, it continues to produce buildings that fall far short of demonstrated efficiency potentials" (p. 142). However, the individual actor is not the only important scale of analysis, and individuals often only have limited control over their total energy use at home and no control over the building's operations and efficiency. Thus higher scales of analysis like households, groups, and buildings also play an important role (Reid, Sutton, & Hunter, 2009).

Third, this project allows for an exploration of group behavior and a research design that explores the possibility that a single building can play the role of such a group. There is a significant economic literature that explores how individuals behave in groups, how this differs from individual decision-making and, in particular, the economic incentives and motivations for taking action among individuals in group settings (Kleindorfer et al., 1993; Olson, 1971; Ostrom, Gardner, & Walker, 1994). In thinking of the building unit as an organization, this project allows for an exploration of some of these concepts. Building on this, the project will also allow for an exploration of the inherent tension between economic drivers of behavioral change – reliant on principles of rational actor decision-making – and social factors – such as norms or attitudes in the group – that may have different (yet still important) influences on behavior.

EXPECTED OUTCOMES & CONTRIBUTIONS

This research is expected to contribute to the field both empirically and theoretically. On the theoretical side, it is hoped that the research will offer new insights into the relationships among and between different actors at different scales that impact decision-making about energy efficiency in residential buildings. More specifically, it highlights how the relationships between these different actors form a cohesive organizational unit bounded by the building, and offers ways to better understand how the characteristics of this organizational unit may impact energy efficiency and consumption.

What we know about groups and organizations is typically applied in the context of commercial firms, not residential buildings; thus, where this research is also unique is in its attempt to extend this line of thinking about organizations to a residential context. This is an underexplored area in the literature.

On the empirical side, the research would support the work of some researchers who have attempted to highlight how social dynamics in buildings and/or organizations can influence behavior (Astmarsson et al., 2013; Chen and Taylor, 2013; Jain et al., 2013; Janda, 2013; Schelly et al., 2011).

Also, most schemes aiming to target behavior change (at any level – individual, firm, industry) fall within the vein of economic-based approaches, which, for the most part, do not attempt to leverage potential social influences, values or attitudes. Ritov and Kahneman (1997) explain that rational consumer behavior is too limiting of an explanatory variable in predicting how individuals value environmental assets and resources. Further, as Kleindorfer (1999) notes, appealing to an individual's civic duty can be a driver of behavior. He explains that in order to see action occur on particular issues of importance, “They must be perceived as important socially and they must be conceived as part of the citizen’s social contract” (p. 55). This indicates a role for behavioral analysis that transcends economic motivations. This research will aim to study buildings and interventions that leverage precisely these influences and thus merit further study and exploration.

More broadly, researchers also acknowledge the necessary social science component of energy research (Sovacool, 2014). There has been a decline in studies of the social aspects of energy use in recent years (Lutzenhiser, 2002). A survey of energy research from 1999-2008 by D’Agostino et al. undertaken in 2011 reveals that the majority of energy research completed over the past decade is heavily weighted towards science and technology, with little emphasis on social science or human dimensions of energy (D’Agostino et al., 2011). Although advances have been made in this realm in recent years – such as the launching of the new Energy Research & Social Science academic journal, and the increase in popularity of events like the Behavior, Energy and Climate Change conference hosted annually by the American Council for an Energy Efficient Economy (ACEEE), much more work still needs to be done, and a rich array of research questions exist that blend sociological and technological aspects of energy.

Ultimately, the research will attempt to extend an organizational line of thinking to a residential context in order to provide a unique approach to an underexplored area of behavior knowledge in buildings.

PLAN FOR THIS RESEARCH

This research is organized as follows. First, background and literature are offered to support the premise that buildings are organizations. This section reviews importing supporting research that helps categorize buildings as organization and identify specific organizational criteria that translate well to buildings. This is presented in Chapter 2. Next, Chapter 3 ties this premise to energy efficiency engagement. It explores a typology for "scoring" the building's organizational characteristics identified in Chapter 2 to predict a likelihood of energy efficiency engagement. Chapter 4 analyzes the large, publicly available New York City energy disclosure dataset to determine which buildings do, in fact, perform better than others, and offers support for the hypothesis that owner-occupied apartment buildings – and cooperative buildings in particular – consume less energy. Chapter 5 takes a closer look at decentralization, and explores the specific case of the cooperative building by analyzing fieldwork and survey results from one Brooklyn co-op building (Building 5). Chapter 6 explores centralization in rental buildings and offers evidence to illustrate that even highly organized initiatives may not be effective in all buildings; in some instances, high incomes override these efforts. Chapter 7 will offer a concluding discussion, some overarching findings and themes, and implications for policy, planning and design.

CHAPTER 2: BUILDING-ORGANIZATIONAL TYPOLOGY

INTRODUCTION

This chapter offers a background and rationale for H1, the initial hypothesis for this work that assumes all buildings to be organizations. In thinking about how to conceptualize buildings as organizations, it is helpful to first discuss the types, structures and functions of organizations. This section will review background and literature on organizations more broadly, and will then parse out specific characteristics of organizations that are deemed useful or important for further exploration in relation to buildings. This will draw on qualitative fieldwork and interviews as empirical support. The chapter will end with a chart summarizing characteristics of organizations that translate well to buildings and that require more focus and attention for the remainder of this research.

Background

The organizational literature is vast, and sub-fields of expertise branch into many directions, including organizational behavior, organizational psychology, and organizational decision-making, each of which is a substantial field in and of itself. This work does not intend to survey and review all such sub-fields, but only to focus on theoretical work that helps define, situate, and frame organizations as units of analysis, and offer an understanding of the characteristics of organizations that are important for the built environment context being explored here. Given the vast interdisciplinary body of organizational literature that exists, it should also be noted that within sub-fields there are often many unsettled debates among researchers. Much organizational literature is still evolving.

Organizations exist in and have an impact on all sectors and industries of our society, including social services, finance, education, culture, and entertainment, and are the mechanisms through which many things are accomplished (Scott, 1991). As Scott (1991) argues, organizations are not just entities that influence the behavior and activities of individual actors, but are the actors themselves. Although Scott (2013) explains that work on institutions – and on organizations as one type of institution – dates back to Tocqueville and Weber, an academic focus on organizations as a distinct field of study arose more recently in the early- to mid- 20th century. Early institutional and organizational theorists that are heavily drawn on and well known include Ronald Coase and Herbert Simon. But, Scott notes, despite early attention on organizations as a unit of analysis "Little or no attention was given to the surrounding social/cultural environment of organizations (Scott, 2013, p. 22).

Organizations exist within what DiMaggio and Powell (1983) term *organizational fields*, or broader categorizations of industries that dictate much of the culture, norms, and standard practices within the organizations in that field. Thus, although individual organizations span a multitude of sizes, types, hierarchies, missions, etc., there is some measure of continuity and shared culture within a given industry (DiMaggio and Powell, 1983). For buildings this is particularly applicable. The wider real estate and construction industry abides by many unspoken rules and conventions regarding the types of structures that are built, what they look like and, more importantly, the materials and methods used to construct them, and this is one of the main reasons green building practices are so slow and challenging to bring to scale as a standard method of construction (Guy & Shove, 2000). In addition, this makes defining a building's boundary a complicated undertaking due to the many actors across disciplines that contribute to the end-product of a built structure.

From an economic perspective, organizations exist, in part, as a mechanism for reducing transaction costs for firms – the creation and formalization of specific roles and tasks within an organization to better achieve certain production and output goals reduces the per-unit-cost for the firm, allowing it to maximize economies of scale (Coase, 1937; Kleindorfer et al., 1993). This economic perspective often exists in tension with the sociological aspects of organizational literature. Both are important and exert influence on actors and outcomes within an organization, and both are relevant in the case of buildings as organizations.

ORGANIZATIONAL CHARACTERISTICS

Organizations have many characteristics; some, but not all, make an easy transition to buildings. This section will review six primary organizational characteristics that I hypothesize can be most effectively extended to buildings. These six characteristics include organizational structure, boundary, size, decentralization, culture, and member role. Each will be discussed below. This section will also discuss other organizational characteristics that may be present in buildings, but not have a related corollary in traditional organizations, and will briefly mention other organizational criteria that are not as strongly linked to buildings.

Organizational Structure/Type

This research begins with organizational structure as the first point of discussion on organizational characteristics because it is an overarching, high-level criterion that drives many other organizational characteristics. Identifying an organization's structure in many ways pre-determines factors such as its level of decentralization, boundaries, transparency, etc. In fact, characteristics like decentralization, boundaries, etc., can be thought of as “structural properties” of an organization (Scott, 1991, p. 258). Thus, it makes sense to discuss it first as a means of establishing a basic framework.

Theorists across many disciplines offer various approaches to understanding organizational structure. A common theme among some is that a vast array of theories and approaches can be boiled down to a more limited number of structures and forms that are repeated often in organizations (George, 2012; Mintzberg, 1992; Scott, 1991, 2013; Shwom, 2009). The structure of an organization is most commonly explained as the way labor is divided among unique tasks and how those tasks are managed (George, 2012; Mintzberg, 1992). Mintzberg (1992) explains, “A limited number of these configurations explain most of the tendencies that drive effective organizations to structure themselves as they do” (p. 3). Scott (1991) categorizes wide and diverse theories of organizational structure spanning disciplines such as sociology, economics, and psychology, into three primary organizational types: rational, natural, and open systems. Briefly, Scott argues that the primary distinction between the three forms is in the treatment of activities, roles and boundaries; open systems, in Scott’s view, acknowledge that the organizational system is always reacting to and interacting with its wider context and, as such, are not clearly bounded, while rational and natural systems are more formally structured and boundary-dependent (Scott, 1991). Rational organizational systems in particular are said to pursue very specific goals and have formalized roles and activities. This approach draws more heavily from an economic vein of thinking. Many other researchers describe a similar organizational type (one that is hierarchically structured and formally organized), although terminology differs. George (2012) categorizes organizations as mechanistic or organic; as expected, the mechanistic structure closely aligns with Scott's rational system. Others argue that traditionally structured organizations (those aligning with Scott's rational system) derive from the work of Weber and from classic rational actor theory (Kleindorfer et al., 1993; Shwom, 2009).

The characteristic of a building that best defines its organizational structure, I argue, is its ownership type. Distinguishing between a rental property, condominium, or cooperative building identifies the primary operational characteristics of the building as an organization. A rental building will have a management company, occupants that act as customers, and an organizational mission of profit and resident retention; a cooperative building will have a cooperative board comprised of residents, occupants that serve as key decision makers, not customers, and an organizational mission of operational efficiency and/or strengthening the resident community. In this way, organizational structure is the key independent variable from which all other characteristics are derived (Scott, 1991).

Interviews with residents of buildings with various ownership types helped to highlight some of these distinctions. Residents of rental buildings tended to report patchy and random interactions with neighbors based primarily only on the shared use of a building common area amenity, little to no involvement in initiatives or events in the building, little communication among residents, and interactions with staff only on a professional level as related to service provision in the building or their apartment. When asked how well she knew her neighbors, one rental occupant explained, "I don't know my neighbors at all. I think it's the funniest part about New York living, you live next to someone for years and you don't know their name. The people I know are random. I'll see people at the gym a lot. And I'll say hi. But I don't know anyone on my floor. I think it's an apartment building thing, a lot of people have that anonymity thing, they want to be anonymous." When asked the same question, a rental occupant from another building said, "I know my neighbors very little. I know the people immediately next to me, because I'll run into them, but I probably don't know even half the people on my floor." Both of these were large, luxury rental buildings, but this was a consistent finding even in smaller or less amenity-rich rental buildings. When asked if the building provided any social programming or activities, or if there were any informal social gatherings formed by residents, the renter of a small rent-stabilized property said, "No. The residents never voice anything. And the building doesn't do anything. No events or anything like that. That's just not what happens here." One resident of a 300+ unit rental building reported that any social interaction in her building was driven primarily by the fact that she has a child, and so occasionally makes use of the community playroom. This same resident noted that the resident portal that all residents use to pay their rent, and which has sections for events, lost and found, for sale, wanted, and recommendations, has zero postings in any category from any of the hundreds of residents. Thus, communication and interaction is low, and this pattern was evident in nearly all rental buildings where interviews were conducted.

Residents of condominium and cooperative buildings tended to report a higher level of interaction with their neighbors, more knowledge about the operations and initiatives in the building, more communication among residents, and more interaction with management or building staff. The occupant of a large condominium building explained, "I think there can be attachment to the building. Here there's some kind of board you can be on. There are two online forums that exist for the building. There's a woman who's sort of the gardener, she's a professional and she's here a lot. And there are definitely people who hang around in the lobby to socialize."

Cooperative building residents had different experiences to share. One resident of a small co-op, when asked to describe the building in three adjectives, said, "The first things that come to mind are community, because we're so small, friendly, because we're all basically friends with each other and hang out in the backyard all the time, and starter, because it is most people's first home purchase." While the tight-knit culture of this building may have something to do with its small size, another resident of a very large (nearly 200 unit) cooperative building also said, "I know my neighbors really well. I know a lot of people in the building. I've been to their apartments. Our kids hang out." This same resident also explained, "We have a building Google group list-serve, and that has people asking for advice or complaining about stuff. And the board is also on that list, so they can hear and read everything. There are also giveaway piles in the lobby."

Thus, in extending the organizational structure characteristic to buildings, I aim to identify first and foremost the building's ownership configuration. In order to develop a typology for this research, buildings will be categorized into rental, condominium and cooperative buildings. It is assumed that variations exist within each category, allowing for a finer grain of distinction if a particular building is to be studied in more detail; for instance, within the rental category exists both public housing and market rate housing. These distinctions will be explored in more detail in subsequent chapters.

Organizational Boundary

The identification of organizational structure or type is directly related to and leads rather seamlessly to the identification of organizational boundary. Many researchers

(Ashkenas, Ulrich, Jich, & Herr, 1995; Scott, 1991; Senge, 2010; Teixeira & Werther, 2013) approach the study of organizations through a systems lens and, as such, debate the role of and definition of boundaries; most advocate for flexible, open systems. As mentioned previously, Scott (1991) identifies rational and natural systems as *closed* organizational systems, with defined boundaries, and open systems as those with less rigidly defined boundaries. The open systems approach views organizations as interdependencies of people, environments, other systems, activities, etc., all of which inform and are informed by each other (Scott, 1991). In this view, "Organizations are not a formal structure (rational) or an organic entity (natural), "but a system of interdependent activities" (p. 25). Other researchers agree, arguing that traditional organizational boundaries contribute to rigidity and inflexibility, while organizations with no boundaries or less rigid boundaries tend to be more agile, innovative, and adaptable, and more resilient in the face of challenges (Ashkenas et al., 1995; Teixeira & Werther, 2013).

Buildings are a unique study in boundaries. Their physical structure dictates a closed system that, by the nature of its physicality, serves to cluster and group actors within its walls. However, despite having a physical structure that serves to separate it from the outside, buildings are never truly closed systems. They are ever dependent on outside resources, infrastructure, and even people for successful operations. In addition, because the organizational field within which a building is created is highly interdisciplinary and dispersed, buildings rely heavily on a range of actors that are well outside of its physical walls. Thus, buildings embrace a tension between both open and closed systems – closed via their physicality, and open via their reliance on a wider context.

Additionally, ownership configuration (i.e. organizational structure in this research) also makes boundary definition murky. A building with a large management company as owner necessarily has organizational boundaries that reach beyond the building walls. They may not even be physically located on-site at the building. This will impact the organizational operations at the building level; conversely, a cooperative building with a co-op board comprised entirely of residents can draw its organizational boundary much smaller, perhaps including only the building itself.

An interview conducted with the sustainability manager of a large northeast property owner corporation helped highlight some of the complexity that occurs when the organizational boundaries cannot be cleanly drawn around a single building, and how this impacts energy efficiency initiatives. He explained, “Organizationally (and this is getting a little into the weeds, but it's important to the energy stuff), we build apartment buildings, all in house, some very big buildings. We do it very well, we know how to construct townhomes to mid-rises, to high-rises in NYC, and part of that process is inherently risk-averse and inherently very cost conscious. What I'm finding, which is an interesting tension, is that very often if it is going to cost a little extra to build green and going to hit the bottom-line revenue for the apartments, even though doing that then will cause the operating expenses to go down over the next 10 years, they won't do it. There's a disconnect. A tension between these different parts of the organization.”

He further elaborated: “Also, there’s the corporate arm, and then there’s the people in the on-site communities. The associates in the on-site communities operate very differently. The majority of the associates in the on-site on communities, their compensation and education levels are dramatically different than the people in the offices in corporate. It's an interesting sort of tension between the offices in corporate and the communities. With CSR (corporate social responsibility) I want the communities involved also. I'm sure this is an opportunity somehow, but part of what I have to do is figure that out. There's this suspicion of corporate (oh, they're pushing stuff on us)."

Thus, it can be said that buildings have both a physical and a social boundary; these two boundary types act on the organization in different ways. In many ways, the activity here of conceptualizing a building as an organization is about exploring where the social and physical boundaries of a building align. The inherently complicated definition of boundaries in buildings only serves to reinforce the importance of boundary as an organizational characteristic in the exercise of conceptualizing buildings as organizations. For purposes of this research and the current typology of characteristics, I focus primarily on social boundaries, with the assumption that the since this work explores built structures, the physical boundary is a given. I categorize the building's organizational boundary as one of three types: Expansive, moderate or contained.

Organizational Size

It is typically the case that the larger the organization the more structured, formalized, and complex its operations, by necessity (Mintzberg, 1992; Perrow, 2014; Scott, 1991). Complex organizations are also not as flexible and cannot undergo change as quickly as smaller, less complex organizations. Scott (1991) describes organizational size as the characteristic that determines how much work or product or output the organization performs or produces. Size can be measured or quantified in a number of different ways, depending on the type of organization, its function, and the goal of the analysis; for instance, good measures of size include number of employees, square footage of space occupied, annual sales, number of products manufactured, or number of people served or assisted, among others (Scott, 1991). Like structure, size is a structural characteristic that acts as an independent variable in determining other organizational characteristics like centralization and formalization (Scott, 1991).

In buildings, I posit that size is best determined by number of households (so, in instances of multiple buildings owned by the same organization, this might be quantified as 5 buildings serving 500 households, for example). Taking this approach, size also dictates level of formalization in buildings. Very large buildings, by nature of having to provide services for many households, are likely to have automated operating systems, common area functions that are pre-programmed or operated by staff on a set schedule, and a cohort of building operators with clearly defined tasks and varying areas of expertise. This is all indicative of organizational complexity owing to the number of organization members and the scope and scale of the organizational operations. Conversely, a small property with only a small number of units may rely on residents themselves for some tasks, and they may be performed in an informal or ad hoc way.

For instance, the residents of Building 5 elected not to hire an on-site property manager. When repairs are needed somewhere on-site in the building or in an individual residence, the residents work with an outside contractor, such a plumber or electrician; daily/weekly tasks, such as hauling recycling out to the curb on designated days, are performed by residents themselves. The residents have also elected to maintain the front plantings, basement and yard area themselves, saving costs on maintenance. As one resident explained, “Our monthly maintenance is pretty low, partly because we don’t have a property manager. We decided instead to rent out the basement apartment for market rent." A large building does not allow for this level of informality and resident choice, simply owing to the scale of activity necessary to house perhaps hundreds of residents.

In this research, I categorize organizational size into small, medium and large, defined by number of households in the building(s). A building with twenty-five or fewer households is classified as small, one with 26-100 households is classified as medium, and one with over 100 households is classified as large.

Organizational Decentralization

By way of definition, a decentralized organization is simply one where the locus of power or decision-making rests not with a single individual, but with members across the organization; power is dispersed (Mintzberg, 1992). Decentralization is beneficial to an organization, Mintzberg argues, "Simply because not all its decisions can be understood at one center, in one brain. Sometimes the necessary information just cannot be brought to that center. Perhaps too much of it is soft, difficult to transmit" (Mintzberg, 1992, p. 96). This helps speed up and streamline communication, as it does not need to travel as far through different divisions of the organization (George, 2012). In addition, decentralization can lead to more motivation and creativity among members at lower levels of the organization (George, 2012). Scott (1991) cautions that although organizational size is linked to level of formality, with larger organizations undertaking more formalized operations, this is not necessarily the case with centralization. Large organizations are not inherently more centralized.

An organization's level of centralization or decentralization is more complicated than it may initially seem, especially when extending the concept to buildings. Mintzberg

(1992) highlights the complexity of decentralization in describing a public library system that is "decentralized" geographically (there are many local branches under the auspices of the central public library), but in which the head librarian of each branch wields all power and makes all decisions. As Mintzberg argues, there is no clear-cut answer about the centralization or decentralization of this library system; as such, he frames centralization and decentralization as two ends of a spectrum, not definitive, black-and-white characteristics of an organization. He cautions that decentralization and centralization should not be used to describe geographic location, and researchers should take care not to confuse the concepts with those of concentrated and dispersed (Mintzberg, 1992). These are especially salient cautionary points for buildings (which are often dispersed across geographies but owned by a single entity).

Residential buildings in some cases span this spectrum between centralization and decentralization. For example, a large developer and management company, such as the owner of Building 2, will likely hold many properties in its portfolio. As such, the owner organization is highly decentralized, giving autonomy and decision-making power to the managers of individual buildings. However, within each building (which, for purposes of this work is the primary unit of analysis), the operation and management of that property is highly centralized. Building 2 is operated in a formalized, hierarchical way, with building staff and maintenance personnel reporting to the property manager, who dictates nearly all of the day-to-day operational schedules, routines, and activities of the building. In interviews, residents of this building have commented that, "Mr. (manager) runs a tight ship," and have listed this manager as one of the best things about being a resident of the building because of how well organized and responsive he and his team are. In Building

5, where decision-making is highly dispersed among residents, one former board member noted, “The board has full voting power, but it just has to be a majority, not unanimous. And anyone who lives in the building can pitch ideas. Then we’ll talk about them at the next meeting.” This reflects a much more informal and decentralized culture. Thus, depending on the building-specific context, both centralized and decentralized operations can be beneficial to a building.

For purposes of this work, organizational decentralization is categorized into three areas: Low, Medium, and High. The assumption here is that a building that falls into the “low” category if it is highly centralized in its operations, with decision making occurring primarily at a central locus; conversely, a building that ranks “high” for level of organizational decentralization is assumed to be highly decentralized, with decision making well dispersed among members (e.g. households or residents).

Organizational Culture

Organizations have unique cultures. Teixeira & Werther (2013) explain, “Organizational culture is the fiber and sinew of all firms. It can be thought of as an organization’s personality – a curious blend of history, successes, failures, beliefs, myths, actions, and rewards” (p. 334). An organization’s culture helps define and strengthen its overall mission and generate a shared source of meaning (Scott, 1991).However, debates exist within organizational literature regarding the direction of influence of goals and culture in an organization. Many researchers define organizational culture broadly as a set of assumptions or tacit values and belief systems that inform how *members* of the organization behave, act, solve problems, and make decisions within the organization (George, 2012; Scott, 1991, 2013). A strong culture can be a means of enacting control over members of the organization; individuals who embrace and act on the defined culture subsequently take certain actions or not based on that organizational framework (Scott, 1991). This top-down view posits that the organization itself has a distinct culture and goals that influence the actors within the organization. Others argue that it is the individuals within an organization that bring their own goals, values and norms to an organization, exerting influence on the organization's culture from the bottom up.

This tension becomes particularly salient in buildings. Buildings are inherently distinct in their cultures, making them good models for an organizational exploration of this characteristic. It is possible – and indeed, fruitful – to view a single residential building – comprised of many individual households, shared community space, building managers, and other staff – as a unique unit, one of a kind, with its own personality and social norms. Yet within this unique microcosm, it is not clear if the building culture attracts a certain demographic of resident, or if residents shape the building's culture. This, in turn, becomes an unanswered question regarding the influences on occupant behavior within buildings. Thus, organizations – and buildings – can serve to both constrain and enable the behavior of individual actors. This ultimately sparks the complex discussion of structure versus agency in better understanding organizational behavior (Andrews, 2008).

According to building managers who were interviewed, there are distinct differences even among buildings that are in very close proximity to one another (e.g. in the same neighborhood or even across the street from one another), are occupied by the same or very similar demographic of resident, and are very similar in built characteristics and design properties. Thus, even in nearly identical buildings managers report distinct differences and unique qualities. Both the residents and the management company shape the building's culture simultaneously, according to one manager. Thus, building culture is iterative, influencing and influenced by the individuals who occupy it, and is likely to evolve over the life of the building. As the manager of Building 2 explained, "When I look at the bigger picture, I can see (Building X) and I can see (Building Y) and we have a building up in Chelsea. And the building is like a living cell of itself. It has its own spark. There are differences in personality. Even in (Building X) and (Building Y), which are right next door to one another…they are different." A building's culture is also reflected in the style and tone of a building's website, for example, which is carefully crafted to project a particular culture and lifestyle to potential residents.

These differences in culture and personality also present additional social and economic complications. Much like commercial property owners, who must deal with the complicated issue of multi-tenanted buildings with a diverse array of individual organizations nested in the building, so to must multifamily property owners deal with a multitude of individual households, all with their own distinct differences in values, culture, income, family composition, motivations, and preferences. These differences manifest themselves socially in different patterns of occupant behavior, neighbor relationships, and informal group formation, and manifest themselves economically in principal-agent misalignments, differences is price and income elasticity, and potential rebound effects when energy efficiency measures are put in place.

As mentioned previously, there exist both organizations and organizational fields. In a discussion about building culture it is important to also note that buildings – specifically urban multifamily residential buildings in New York City – exist within a specific organizational field, namely, the New York City construction and real estate market. Names like Trump and Durst conjure up images that are specific and New York-centric. Although there exist a myriad of building types, sizes and service levels in New York, there also exists a pre-defined organizational space with a host of unspoken expectations, norms, and framing cultural ideals that in many ways shape the outcome of individual buildings. As such, it is helpful to highlight the fact that buildings both define their own unique culture while being situated within the context of a larger NYC building culture.

For purposes of this research, it is helpful to develop a way to *categorize* organizational culture – a subjective concept – in buildings. Although a list of adjectives could help describe a building's personality or aesthetic, this list could become cumbersome and, if too many descriptors are added to it, watered down in meaning. I argue that part of what determines the culture that is visible and tangible in a building is the overall mission or goal of the building as an organization. Much like a nonprofit's mission statement, this organizational goal helps guide and inform many aspects of a building's operations. This goal is shaped in part by the owner organization's desire to project a particular aesthetic to residents and in part by residents' demand for a certain lifestyle. Thus, in conceptualizing buildings as organizations for this research, I identify organizational culture as the building goal, and hypothesize that the most visible of a building's goals is the emphasis or intensity a building places on economic versus social motivations. For instance, some buildings will focus heavily or even entirely on generating a profit and retaining residents (via lease renewals) with little to no emphasis on community building or collective social relationships. Other buildings may focus more effort on generating a shared sense of community. I therefore categorize this organizational characteristic as a spectrum or intensity scale that progresses from least engaged and collective culture to most engaged and collective culture as a building spans the spectrum from economic to social goals.

At the furthest left hand side of the scale, economic intensity is higher, and the primary organizational goal of the building is receiving revenue for the provision of shelter. This category is likely to only contain rental properties. In this classification the building (or building owner) does only what is necessary (adequate heat during the months required by law, building up to code, fixtures in bathrooms and kitchens operational, etc.) to ensure apartments are occupied and payment is received for the use of those apartments. In the middle of the spectrum economic and social goals are likely to overlap, and green operations will come into play (because green building features can serve as both an economic asset, driving rents higher and allowing for green marketing, and as a community attribute, offering residents shared initiatives such as composting and recycling). For instance, in Building 3, a luxury green residential property, the management company is primarily concerned with keeping residents happy so they sign lease renewals (retention), and saving costs by operating the building in an efficient manner. The building is marketed as “green” but this is more a conceptual marketing tool than a significant driver of organizational operations. Thus, in this building, the goal falls more clearly on the economic side of the spectrum. In Building 2, the owner organization and on-site property manager place a strong emphasis on energy efficiency. All staff members are highly trained in energy and resource efficiency in building operations, and the property is operated with a clear goal of conservation. This property, too, is a luxury green building, concerned about retaining residents, but in this instance, the energy efficiency efforts not only help garner higher rents, but come along with a clear mission of environmental conservation. Thus, Building 2 may fall more in the middle of the economic – social spectrum. In a cooperative building like Building 5, the building will fall further to the right extreme of the scale, where intensity of social engagement is higher, and economic efforts lower. This building places an emphasis not only on operating the building efficiently, but doing so in an inclusive way, and placing emphasis on the activities and collective ownership that exists.

However, it is important to note that no building will cleanly fall at only one end of the spectrum, and this classification is a simplification for purposes of illustrating the range of intensity between economic and social goals. Nor is it an exhaustive exploration of building goals, but a way of highlighting and exploring what I argue is the most common high-level area of focus (a building organization's attempt at balancing the tension between economic interest and social collectivity) that is likely to inform culture and play a role in a residential building's operations.

Organizational Member Role

Since organizations do not operate without people, it is worth also discussing how these individuals are segmented into distinct roles and task assignments. Researchers approach the discussion of "organizational members" in a variety of ways. Some seek to define the amount of power and control certain individuals may have over others and the delineation of tasks (George, 2012; Scott, 1991); others discuss how decisions are made by individuals in organizations (Kleindorfer et al., 1993). Still others use organizational structure to define particular role categories that together comprise the organization as a whole, such as analyst, support staff, and technical expert (Mintzberg, 1992). What is consistent is that the role of the members is seen as an outcome of many of the previously discussed organizational parameters.

Most researchers use the term “employee” to describe member role, but for purposes of extending this conversation to buildings, “member” is a more appropriate term; not all members of the organization need be employed by the building organization in order to impact and play a role in the organization. In buildings, I intend to take a finer level of specificity by focusing on the role of *residents* as members; it is assumed that employees of the owner organization will necessarily play a decision-making role, but the role of the resident will vary across buildings, and it is this piece that allows for an interesting and unique extension of this characteristic to buildings.

I argue for this research that residents can take one of three primary roles in a building: customer, stakeholder or decision-maker (full member). In some buildings (rentals in particular), residents play the role of customer; they are outside of the main decision-making locus and, in fact, are likely not interested in being a part of it. They have expectations for level of service and amenities, and view the owner or management company as a service provider. The management company, in turn, is accountable to the residents owing to the monetary transaction that occurs in the payment of rent in exchange for services each month. Their primary goal is ensuring customer (resident) satisfaction and, hopefully, retention. Condominium and cooperative buildings are likely to have different scenarios. In a condominium, residents play a more significant role in the operation and management of the building, but are likely not making key decisions; they are stakeholders in the process due to their financial stake in the property. In cooperative buildings, where residents comprise the cooperative board and are fully responsible for budgetary decisions, bill-paying, capital improvements, and other major decisions, the residents ***are*** the organization and constitute it fully themselves; they are not simply customers or stakeholders of the organization. In each of these three categorizations of residents, economic considerations may play a larger or smaller role depending on the building and resident characteristics. For instance, some residents-as-customers in expensive luxury buildings will pay little attention to the costs they incur for electricity each month, while others will pay more attention and adjust their behavior accordingly.

Interviews with residents of buildings with various ownership structures helped highlight some of these distinctions. When asked if they believe people form attachments to their buildings and what unique things their buildings add to their lives, residents of rental buildings consistently commented on the use and provision of a certain level of amenities in their buildings, including children's playrooms, gyms, pools, rooftop gardens, etc., framing their role as a customer. One rental occupant commented, "I feel like the staff adds to it (what the building provides to residents), and the amenities, there's a little gym and a little pool, and a laundry room. I think those kinds of things help it feel more like a home. Little personal touches, like how they decorate the lobby and welcome you when you come home. And the rooftop is nice too."

When asked about unique things the building adds to their lives, residents of cooperative buildings spoke more frequently about a sense of shared community and things like resident initiatives in and around the property. A resident of a large cooperative explained, "People definitely have an attachment to the building. It's a very distinctive building. We're improving the building a lot. We just did a garden, we're fixing the outside. Also, it's very big so it's like its own neighborhood, there's a critical mass."

Interestingly, during interviews renters consistently tended to refer to the initiatives, amenities, and events in the building using terms like "them" and "they", while cooperative residents tended to use "we" and "us" when referring to the building. Even renters in older, rent-stabilized properties without higher-end amenities referred to "the building" as an autonomous offsite entity, a "them" not a collective "us." Some residents noted differences even between condos and coops, although both are owner-occupied. One explained, "It is different here (in our co-op) than the condo buildings we looked at when we were ready to buy; because it's a co-op, it's more shared space. Serving on the board means you're basically a volunteer, there's nothing that says you have to serve, but the common understanding is that we all bought into this." This comment highlights the shared accountability and decision making that is more likely to occur in a cooperative building.

This distinction – between customer, stakeholder and decision-maker – heavily impacts the process the building must undertake to implement long-term goals and capital improvement projects, and generally keep the building operational in a sustainable and forward thinking way.

See Table 2.1 for a summary and description of all of the above organizational characteristics as they are applied to buildings in this research.

ADDITIONAL BUILDING CHARACTERISTICS

Buildings have some unique characteristics that often play out in an organizational context and have some corollary to organizations, but do not translate directly. In other words, these building-specific characteristics are not likely to be studied in organizational literature, but play a role for the purposes of this research. These include length of tenure of resident, and level of amenities and service (which I group together here as building status). Each of these will be discussed below, and are included in Table 2.1 as organizational characteristics.

Resident tenure

Length of resident tenure generally refers to how long residents remain occupants of their current building. This can be best equated to employee turnover in traditional organizations. However, turnover is typically a measure of an organization's ability to retain talent and encourage commitment and loyalty to their brand and firm. While there is some measure of brand loyalty in a management corporation's intent to retain current residents, in a residential context people far more often have personal circumstances that drive their decision to move or not, regardless of their like or dislike of the building itself. For instance, a resident of a large rental building explained, "This is a transient building. A lot of companies rent apartments here for their employees who are here temporarily. They must have a continuous thing with the building." The manager of a large green building in Lower Manhattan noted, "A lot of residents live here because their job keeps them here, but as soon as their job moves, they follow." A resident of a cooperative building with a small, tight-knit community remarked, "This building actually has pretty high turnover, I think because it's a very family friendly building. People move here, and they have kids, but then the kids get bigger and they have to move somewhere else for more room." Thus, life circumstances drive moves in/out of buildings more than building or management company circumstances in some cases, so resident tenure can't be pointed to as an outcome of the building's organizational operations. However, resident tenure is likely to impact organizational characteristics in the building such as involvement in social activities and development of informal friendships with other residents; this makes resident tenure an important characteristic in understanding why and how some people become more involved and engaged in the community of the building than others, which may have implications on the success or failure of building-led initiatives.

For purposes of this work, resident tenure is categorized into short-term, medium-term and long-term. It should be noted that it is difficult to classify a building into a single category; as mentioned above, people move for personal and individual reasons, so even in a building where expected length of tenure is long (like a small, community-driven cooperative building), there may still be a high turnover among some residents, which has little to nothing to do with the organizational operation of the building. Similarly, in a building with typically high turnover (like the rental mentioned above with many apartments for temporary corporate relocations), there are still some residents who are "lifers," and have resided in the building since its opening. Thus, there will always be anomalies to this rough categorization.

Building Status

Level of amenities and level of service are qualities unique to residential buildings. They do not necessarily have a clear extension in traditional organizations. Level of amenities refers to the availability of on-site activities, spaces, and "extras" that go beyond the resident's individual apartment. Depending on the building, this can include basics like a simple lobby and shared laundry room to a pool, spa, and cleaning services at very high-end buildings. Similarly, level of service refers to the availability of on-site staff for resident needs. This can include a part-time doorman and on-site superintendent to a full-time concierge and personal trainers, depending on the building. Taken together, these distinctions help categorize residential buildings into price and luxury categories, and determine the overall "status" of the building. They also help add a finer grain of distinction to the member role categories described above. For instance, buildings with a very high level of both amenities and services are likely to have residents that fall into the category of "customer."

For purposes of this research, building status is categorized as standard, moderate, and luxury. Roughly, a standard building would be a walk-up (non-elevator) property with no additional resident amenities on-site (no doorman, no common spaces or shared amenities, etc.). A moderate building would be a property with mid-range amenities, such as an elevator, on-site laundry, and part- or full-time doorman. A luxury property would be a building with a range of high-end offerings in both service and amenities, such as elevators, full-time doorman, gym, pool, in-apartment washers/dryers, etc.

Both resident tenure and building status characteristics are likely to impact the organizational operations of the building and the building's energy outcomes in some ways, and will be explored as needed throughout subsequent sections of the research in order to address their role in building operations or energy efficiency. They are added to Table 2.1 as organizational characteristics.

ADDITIONAL ORGANIZATIONAL CHARACTERISTICS

There are other organizational characteristics that researchers devote significant time to exploring that do not translate as well to buildings. These will be acknowledged briefly.

First, researchers of organizations devote a good deal of attention to understanding how individual differences in motivation, values, and personality impact organizational outcomes, goals, and work environment (George, 2012). Because this research focuses on buildings – and on residential buildings specifically – it is already assumed that every household and resident brings to the table a heterogeneous and varied set of needs, preferences, lifestyles, values, opinions, etc. Residential properties are inherently unique in this way because they are at their most basic a clustering of individual homes, the place at which people are most themselves. Differences in household "personalities" are assumed to exist, and this work focuses on their contribution to the overall building culture, discussed as one organizational characteristic above, but does not focus on individual households as separate units of analysis.

Also, as a sub-point of organizational structure, many researchers devote significant attention to the sectors, departments, and divisions an organization should be sub-divided into (Ashkenas et al., 1995; Mintzberg, 1992). In a building, much of this is predetermined at the design and construction stage of the property development; at this point the architect and developer determine the number of households, common space square footage, and other design parameters. These decisions, in turn, determine the staffing needs on site when the building is occupied. In most cases, the segmentation of divisions and departments in the owner organization itself exists well before the building is occupied. As such, this work focuses on a broader extension of organization structure in buildings by examining ownership type (rental, condominium or cooperative), as explained previously.

Table 2.1 Organizational Criteria in Buildings

Organizational Characteristic	Building Translation	Criteria / Categorization	Description/Assumptions
Organizational Characteristics			
Organizational structure/type	Ownership configuration	Rental Condominium Cooperative	Distinguishing between a rental property, condominium or cooperative building identifies the primary operational characteristics of the building as an organization.
Organizational boundary	Bldg-Org boundary	Expansive Moderate Contained	Buildings have both a physical and a social boundary. The physical boundary is determined by the tangible material structure of the building. The social boundary -- which is the focus here -- is determined by ownership configuration. A building with a large management company as owner necessarily has organizational boundaries that reach beyond the building walls; conversely, a cooperative building with a co-op board comprised entirely of residents can draw its organizational boundary much smaller, perhaps including only the building itself.
Organizational size	Building Size (Number of Households)	Large (200+ units) Medium (51-200 units) Small (50 or fewer units)	The larger the organization the more structured, formalized, and complex its operations, by necessity (Mintzberg, 1992; Scott, 1991). This should hold true in buildings as well. Organizational size in buildings is determined by number of households. Very large residential buildings will have more advanced and complex building operations, requiring a more formalized staffing structure and heirarchical management team. They are likely to be managed by large corporate owner entities, with primary decision makers located offsite.
Organizational decentralization	Ownership decentralization	Low (Centralized) Medium High (Decentralized)	In decentralized organizations, the locus of power and control is dispersed. Decentralization in buildings should not be confused with geographic dispersment; many owner organizations own properties that are widely dispersed among many cities, but each building is highly centralized in its operations. Decentralization in buildings can be low, medium, or high.
Organizational culture	Building goal (intensity of economic vs. social goals)	Strongest economic goal (weak social goal) Balanced economic & social goals Strongest social goal (weak economic goal)	An organization's culture helps define and strengthen its overall mission and generate a shared source of meaning (Scott, 1991). Buildings are inherently distinct in their cultures; part of what determines the culture that is visible and tangible in a building is the way the building balances economic goals of profit and resident retention with social goals like community building. Much like a nonprofit's mission statement, this goal spectrum helps guide and inform many aspects of a building's operations. I argue that this scale progresses from least engaged and collective culture to most engaged and collective culture as a building spans the spectrum from profit to community. No building will cleanly fall into only one category, and goals may overlap.
Org Member Role	Resident Role	Customer Stakeholder Member / Decision maker	The role of the resident will vary across buildings, and it is this piece that allows for a unique extension of this organizational characteristic to buildings. In rental buildings, occupants are primarily customers of the organization. In cooperative buildlings, they are members of the organization (decision-makers). In other situations, they may be a stakeholder, in which case they are more than just a customer, but do not make major decisions.
Building Characteristics			
Organizational Characteristic	**Building Translation**	**Criteria / Categorization**	**Description/Assumptions**
Employee tenure	Resident tenure	Short-term Medium-term Long-term	Length of resident tenure refers to how long residents remain occupants of their current building. Resident tenure is likely to impact organizational characteristics in the building such as involvement in social activities and development of informal friendships with other residents; this makes resident tenure an important characteristic in understanding why and how some people become more involved and engaged in the community of the building than others.
N/A	Building status	Standard Moderate Luxury	Level of amenities and level of service are qualities unique to residential buildings, and do not necessarily have a clear extension in traditional organizations. Level of amenities refers to the availability of on-site activities, spaces, and "extras" that go beyond the resident's individual apartment. Level of service refers to the availability of on-site staff for resident needs.Taken together, these distinctions help categorize residential buildings into price and luxury categories, and determine the overall "status" of the building.

CHAPTER 3
ENERGY EFFICIENCY ENGAGEMENT IN BUILDING ORGANIZATIONS

INTRODUCTION

This research has now established the premise that all buildings can, and in many ways, do, function as organizations. Taking this a step further, this chapter explores the hypothesis that within building organizations, some characteristics are more likely to lead to energy efficiency engagement than others. This analysis rests on the prior chapter's selection of six organizational criteria that are particularly relevant to and translate well to buildings, along with two building-specific criteria that play out in an organizational context. This chapter develops a scoring methodology for each of these 8 characteristics, with the hypothesis that buildings with higher scores have a higher likelihood of energy efficiency engagement given particular organizational criteria. This comes with the acknowledgement that organizational criteria will be context driven and building-specific, with no two buildings operating as an organization in exactly the same way; as such, the scores are meant to rest on a spectrum. The score itself is meant to offer guidance, but not definitively place the building into an "energy efficient or not" categorization. This chapter uses seven of the buildings outlined in Chapter One as empirical examples by which to "test" the scoring system. They serve as mini-case studies. It also relies on actual energy consumption data for these seven buildings from New York City's 2013 Local Law 84 (LL84) disclosure data.

This chapter is organized as follows. First, it re-introduces the eight organizational characteristics explained in the previous chapter, and outlines scoring criteria for this chapter. Then it reviews the each of the characteristics in turn, outlining the role each is expected to play in energy efficiency. It then presents the score for each building in a table and discusses some important findings and conclusions from the scoring outcome. It concludes with a selection of a subset of buildings to be studied in further detail in remaining chapters. To ensure the privacy of residents who were interviewed, some building information has been anonymized.

SCORING CRITERIA

As introduced in the previous chapter, eight organizational characteristics were explained in relation to buildings, and specific criteria for each characteristic were outlined. As a brief review, the eight characteristics and the criteria for each are listed below:

1. Organizational structure: Rental, condominium, or cooperative
2. Organizational boundary: Expansive, moderate, or contained
3. Organizational size: Large, medium, or small
4. Organizational decentralization: Low (centralized), medium, or high (decentralized)
5. Organizational culture: Strong economic goals, balanced economic and social goals, strong social goals
6. Organizational member role: Customer, stakeholder, or decision-maker
7. Resident tenure: Short-term, medium-term, long-term
8. Building status: Luxury, moderate, standard

I argue that the criterion for each of these eight characteristics rests on a spectrum, and that taken together these characteristics are important contributors to a building's likelihood of and willingness to engage in energy efficiency activities and initiatives. In fact, I hypothesize that the criteria for each characteristic are ordered; thus, an ordinal scale can be given to each, creating a simple scoring system, with higher combined scores on the eight characteristics indicating a higher likelihood of engaging in energy efficiency behavior. I propose the following simple scoring system:

Table 3.1 Energy Efficiency Engagement Scores: Simple Model

Building Characteristic	**Criteria**	**Score**
Organizational Type	Rental	1
	Condominium	2
	Cooperative	3
Organizational Boundary	Expansive	1
	Moderate	2
	Contained	3
Organizational Size	Large	1
	Medium	2
	Small	3
Organizational Decentralization	Low	1
	Medium	2
	High	3
Organizational Goal	Strong economic goal	1
	Balanced economic & social goals	2
	Strong social goal	3
Member Role	Customer	1
	Stakeholder	2
	Member / Decision maker	3
Resident tenure	Short-term	1
	Medium-term	2
	Long-term	3
Building status	Luxury	1
	Moderate	2
	Standard	3

Each of the eight characteristics will be discussed in turn below in order to offer a rationale and hypotheses for this scoring methodology. The empirical effectiveness of this scoring system will be tested later in the chapter.

Organizational Type

As explained in the previous chapter, organizational type is categorized into rental, condominium or cooperative building. The ordinal scoring for this characteristic is from 1 to 3, moving from rental to cooperative, with the hypothesis that the lower score (rental property) will have a lower likelihood of energy efficiency engagement, while a higher score (cooperative building) will have a higher likelihood of energy efficiency engagement. The rationale for this scoring methodology rests on the assumption that principal-agent issues will be highly impactful in rental properties, where neither owner nor renter has a strong incentive to invest in energy efficiency. Renters are often occupants for only a short time, and often do not control much more than plug load in their individual apartments. Cooperative residents, on the opposite end of the scale, are financially invested in the overall performance and efficiency of the property, as purchase of a co-op unit results in ownership of a set number of shares of the whole building premises.

Organizational Boundary

Organizational boundary, as explained previously, is categorized as expansive, moderate, or contained. It is hypothesized here that an organization with an expansive boundary – a building owner with holdings of perhaps a hundred properties and thousands of apartment units, for instance – is less likely to be able to focus energy efficiency goals on a single property. Portfolio-wide scale up of energy efficiency initiatives are likely to be somewhat “light”, as they must be generic enough to expand across the portfolio (or some portion of it, if the owner organization implements a pilot project), which means an inability to incorporate building-specific context and the unique conditions of a particular building and its occupants. Buildings with this type of organizational boundary (an owner organization managing many properties) receive a lower score. Properties with a contained boundary, such as a single-building owner or an owner-occupied cooperative, can focus exclusively on the cost, efficiencies, operations, maintenance and capital improvements of a single building, taking into consideration the needs, opinions, comfort requests, and other non-technical factors that they or others may hold in regards to the building. This gives the contained-boundary property an advantage in implementing projects and initiatives (energy efficiency or other). As highlighted in the previous chapter, most researchers (Ashkenas et al., 1995; Scott, 1991; Teixeira & Werther, 2013) advocate for open systems without boundaries. Although this is a valid point, I believe buildings are a special case, and can benefit from more contained boundaries that allow for more targeted and tailored capital improvements and energy efficiency projects.

Organizational Size

When extended to the building unit, organizational size is determined by number of households in the building (categorized as small, medium, or large). It is hypothesized that larger buildings will be less likely to be engaged in energy efficiency initiatives. Larger buildings will have more complex operations and a more hierarchical staffing structure, and this complexity may lead to less innovative decision-making among staff in terms of daily operations and maintenance. Also, findings from interviews and surveys indicate that the larger the building, the more anonymity there tends to be between and among residents; I posit that this results in lesser knowledge of and accountability for both individual and building-level consumption. Conversely, in smaller buildings managers and operators may have more flexibility and less hierarchy, and the behaviors of all residents are more visible to one another, which may result in a higher level of accountability among residents. Thus, large buildings receive a score of 1, and small buildings a 3 in this scoring system.

It should be noted that some very large building are also green buildings, particularly in New York City, whereby the owner organization has made energy efficiency an explicit goal. Similarly, large buildings do have the added benefit of economies of scale, which may make them more efficient than smaller properties. Both of these caveats should be taken into consideration when thinking of large versus small buildings – context will be important.

Organizational Decentralization

Organizational decentralization is hypothesized in this work to be high, medium, or low in buildings, with highly decentralized organizations receiving a score of 3 in this system, and more centralized organizations receiving a score of 1. As explained previously, level of decentralization in a building has a large impact on the locus of decision-making and power in the building. I hypothesize that in properties with highly dispersed decision-making, such as a cooperative, more ideas can be pitched, debated, and acted upon, from both staff and residents, which opens up space for new energy efficiency initiatives.

Organizational Goal

As explained in the previous section, I hypothesize the primary organizational goals of a building to span a spectrum from least to most socially driven, as follows: Strong economic goals, balanced economic and social goals, and strong social goals. Although there is some overlap in the categories of this spectrum and determining the general "weight" of a building along these goals is subjective, it is generally assumed here that the lower end of the spectrum (with goals focused mostly on economic interests, such as profit and resident retention) will be buildings with a lower likelihood of energy efficiency engagement. Rationale for this hypothesis is straightforward – buildings with a goal of profit will focus little to no effort on energy efficiency, especially if such initiatives require either a large capital investment with a long payback period, or a concerted effort to engage residents. Thus, the scoring for this characteristic ranges from 1-3, moving from economic to social goals. As noted earlier, a single building will not cleanly fall into only one end of the spectrum, and oftentimes will have goals that contribute to both economic and social outcomes. Additionally, context and building-specific details will become very important in better understanding how the organizational goal operates in reality – for instance, in one "green building" the energy efficient features may not be significant or legitimate enough to merit much in the way of social outcomes or community building; resident retention may still be the main goal, with the green features being used primarily as a marketing tactic.

Member Role

Members (residents) of building organizations can play the role of customer, stakeholder, or decision-maker. I hypothesize that on a scale of least to most engaged in energy efficiency, residents in the role of customer would be least likely to make a concerted effort to participate in efforts to lessen building-wide or individual unit energy consumption. These residents have little to no involvement in anything beyond their individual apartment unit, and this is likely to impact their interest in collectively working to lessen consumption. Additionally, as a customer of the building they are likely to have service and comfort expectations that the owner organization will work hard to meet, often at the expense of building-wide efficiency initiatives. Residents in the role of decision-maker, conversely, will necessarily have a big-picture view of the building and its operations, giving them more knowledge, information and incentive to make energy efficiency choices. Thus, I score residents-as-customers with a 1, and resident-as-decision-makers with a 3.

Resident Tenure

It is expected that some buildings will retain residents for a long period of time, while other buildings will have high turnover. This is due in part to the owner configuration (e.g. rental apartments are more likely to have frequent turnover, while cooperatives are more likely to have long term residents), but also to individual and personal circumstances unique to residents. Holding all else equal, it would be expected that long-term residents will have more of a stake in the overall building and will be more invested in energy efficiency; as such, residents with long-term tenure are scored a 3 in this system. Conversely, short-term residents are hypothesized to have less of an investment in the overall building, and therefore expected to be less engaged and committed to any building-wide energy efficiency initiatives; this category is scored a 1 in this system.

Building Status

Level of amenities and level of service – which together comprise building status – are expected to span a range from standard to luxury, and the hypothesis here is that luxury buildings are less likely to be energy efficient or engage in energy efficiency initiatives. Buildings with a high level of both service and amenities necessarily require a higher consumption of energy to power the gym, keep the children’s play room air conditioned, and give residents in-apartment washers and dryers, among other amenities. Similarly, a 24-hour staffing presence requires more resources to allow managers and staff to run the building and maintain a personal level of comfort while doing so (via a private office, or chair with computer at the front desk, for instance). Additionally, the high demands of residents for a luxury residence are likely to influence the amount of pressure management is willing to put on occupants to lessen consumption or recycle, for instance. Owners of these types of buildings are likely focused on keeping residents happy at all times; enforcing new "rules" that impose on residents' lifestyles are not likely to be pushed at the expense of resident comfort or convenience. Thus, the lowest score in this category is the luxury building, which receives a 1. On the other end of the spectrum, a standard building (described here as a walk-up (non-elevator) property with no additional resident amenities on-site and no additional services beyond the apartment) would require less energy simply by way of its less intensive level of service, staffing, and amenities. This type of building would receive a 3 in this scoring system.

Limitations

It is worth discussing a few caveats and limitations to this system. First, it should be acknowledged that some of these characteristics relate directly to energy consumption while others relate more to energy efficiency engagement. For example, building status, described above as the bundle of amenities and services offered to residents, would directly impact building energy consumption (simply as a result of more energy-consuming spaces and features), whereas member role is a more indirect influence on how residents may engage with one another and the building on shared initiatives to conserve energy and resources, but not directly on how many elevators are powered on at a given time, for example. This can complicate the utility of this scoring system. However, the goal here is to attempt to develop a holistic system that is illustrative of the ways buildings can act as organizations and how these particular organizational characteristics may impact energy efficiency. Thus, there will necessarily be some overlap between some physical characteristics and associated organizational characteristics of the building, and it is difficult to disentangle the two. An aim of this work is to better understand and make explicit this distinction, and focus particular attention on the organizational drivers that work alongside the physical characteristics.

It is also important to note that these categories and the scoring system developed here cover a range of gray areas, and are subjective. In particular, they are heavily reliant on individual building context. A rental building will not necessarily always be less energy efficient and small buildings will not necessarily always be more energy efficient. Additionally, some characteristics might be weighted more heavily in one building than in another, or have more of an impact when taken in combination with other characteristics. For instance, a green rental building may perform better than a non-green cooperative, because the energy efficiency initiatives in the green building outweigh other drivers of energy efficiency in the cooperative. At the same time, a luxury green building may perform worse than a standard, non-green rental building because the luxury features of the green building outweigh the green features, driving up consumption. Thus, the scoring methodology is simply meant to offer a way to quantify some of the subjective and conceptual ideas about buildings-as-organizations, but is not meant to be taken definitively. To that end, later in the chapter some effort is devoted to teasing out the way some characteristics may “trend together” or have more influence when grouped.

Finally, physical characteristics such as building age, number of stories, and envelope material will obviously play a role in the actual energy outcomes of the buildings presented here. Any in-depth analysis would attempt to hold constant the physical characteristics in order to better understand the non-physical organizational characteristics, but given the small sample size here, advanced statistical analyses are not possible. To remedy this, the next chapter follows up with more in-depth statistics and a large dataset.

Despite these disclaimers, the analysis in this chapter still presents a fruitful exercise in exploring the range of impacts some of these characteristics may have. I argue that the characteristics may indicate a *predisposal* or *likelihood* to undertake energy efficiency initiatives. In other words, I hypothesize that with a higher organizational score in these areas, the ***cards are stacked in favor of energy efficiency because the organizational drivers that make this engagement easier to implement are present***.

To illustrate how the scoring system may play out in real buildings, I present two generic examples: First, a very large luxury rental building with expansive organizational boundaries, highly centralized operations focused primarily on resident retention and revenue growth, and occupants with very little input or decision-making (because they are primarily customers) may be less likely to push energy efficiency initiatives in the building. As a rental building, the principal-agent issue will come into play, discouraging the owner from making new energy efficiency upgrades (unless the building was built green to start). Also, as customers, residents will have little say in how the building is operated and, as renters, are likely to have less interaction with their neighbors, as interviews have illustrated. They are likely to leave more often, spending two or fewer years in the building, and the luxury features consume a lot of energy on-site. Given the proposed scoring system outlined above, a building such as this one would score a 9.

On the opposite end of the spectrum, a cooperative building with a contained boundary (just the single building), a small number of households where decision making is highly decentralized, community engagement is an important goal of the building, and residents are key decision-makers may be more likely to care about and become engaged with energy efficiency. Residents have a strong incentive to care about cost and efficiency, because there is no need to distinguish between principal and agent. The building has only a moderate amount of features and amenities, and resident tenure is typically long-term. A building such as this one would score a 25 on the above scoring system.

Thus, although hypothetical, this scoring system may help identify buildings that could be predisposed to energy efficient operations and initiatives. These characteristics may give the building an ***organizational advantage***.

METHOD

In order to test this scoring system on actual buildings, a subset of properties was selected from the ten buildings listed in Chapter 1. These buildings were selected because they had site and interview data available ***along with*** whole-building energy consumption data (which was not available for every property studied in this research); this allowed for comparison of both subjective and more objective/observed data.

Data collected from each building needed to be sufficient enough to evaluate each property along each of the eight characteristics of the scoring system. To that end, data collected included a combination of resident interviews, building manager interviews, review of materials such as building websites and management company websites to ascertain number and type of properties owned, site visits, review of documents, permits, and ownership information available from the New York City Department of Buildings and New York City Department of Finance, and the collection of annual energy consumption data for each building from the City of New York. Annual energy consumption data is in the form of source Energy Use Intensity (EUI). EUI measures whole-building energy consumption and is self-reported by the building owner using the Environmental Protection Agency's Portfolio Manager tool. As explained by the City, the site EUI variable is, "The energy use intensity divided by property size, as calculated by Portfolio Manager, at the property site. This equals the amount of energy consumed at the site in kBTUs per gross square foot (kBtu/ft^2) (City of New York, 2014). The median site EUI for a multifamily building in New York City in 2012 was 121 kBtu/ft^2 (City of New York, Office of the Mayor, 2014).

RESULTS: STUDY BUILDING SCORING

Using the system developed for this research, each building was analyzed and given a corresponding score as a preliminary test of the scoring system. Scores for each of the seven buildings are presented in Table 3.2. Scores are presented along with each building's actual source EUI, as reported in the 2013 LL84 Disclosure Data. Overall, organizational scores for the seven buildings ranged between 10 and 22 for this first attempt at scoring. Source EUI for the seven buildings ranged between 89.7 kBtu/ft^2 and 259.5 kBtu/ft^2. As a point of comparison, the median source EUI for a NYC multifamily building in 2013 was 121 kBtu/ft^2. The three buildings tied with the lowest score (10) were large, luxury Manhattan rental properties. The building with the highest score (22) was a mid-rise Brooklyn cooperative building.

Table 3.2 Building Energy Efficiency Engagement Scores

	Building 1		Building 2		Building 4		Building 7		Building 8		Building 9		Building 10	
Building Characteristic	**Criteria**	**Score**	**Criteria**	**Score**	**Criteria**	**Score**	**Criteria**	**Score**	**Criteria**	**Score**	**Criteria**	**Score**	**Criteria**	**Score**
Organizational Type	Rental	1	Rental	1	Rental	1	Rental	1	Condo/Rental	1.5	Cooperative	3	Rental	1
Organizational Boundary	Moderate	2	Moderate	2	Contained	3	Moderate	2	Contained	3	Contained	3	Moderate	2
Organizational Size	Large	1	Large	1	Medium	2	Large	1	Medium	2	Medium	2	Large	1
Organizational Decentralization	Low	1	Low	1	Low	1	Low	1	Medium	2	High	3	Low	1
Organizational Goal	Economic	1	Economic	1	Balanced	2	Balanced	2	Economic	1	Social	3	Economic	1
Member Role	Customer	1	Customer	1	Customer	1	Customer	1	Customer/ Stakeholder	1.5	Member	3	Customer	1
Resident Tenure	Medium-term	2	Medium-term	2	Long-term	3	Long-term	3	Medium-term	2	Long-term	3	Medium-term	2
Building Status	Luxury	1	Luxury	1	Moderate	2	Standard	3	Luxury	1	Moderate	2	Luxury	1
TOTAL SCORE	**10**		**10**		**15**		**14**		**14**		**22**		**10**	
Actual 2013 Source EUI	**135.8**		**202.2**		**120**		**97**		**259.5**		**89.7**		**149.6**	

**Median NYC Source EUI 2013: 121*

As the results above indicate, using the scoring system as-is results in organizational scores that do not correspond as a direct match to the buildings' EUI scores. Figures 3.1 and 3.2 help illustrate this. Figure 3.1 graphically represents the consumption of energy of each building relative to the other six buildings and to the NYC median source EUI for 2013. Figure 3.2 reorders these same buildings based on their scoring in the organizational system here, while retaining their EUI circle size. As is evident from these two figures, a number of properties did not perform as expected, consuming either more or less energy than their score in the organizational/energy efficiency engagement system used here would lead us to expect.

Figure 3.1. Study buildings ordered by energy consumption (2013 source EUI (kBtu/ft^2)

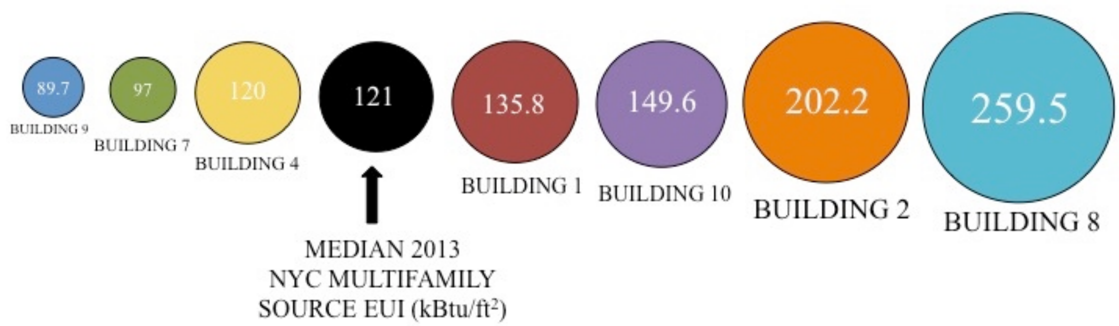
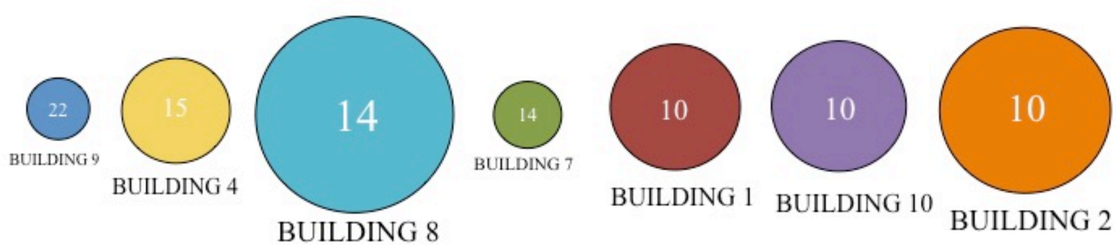


Figure 3.2. Study buildings ordered by organizational criteria score (*circle size reflects EUI)



A few specific examples should be discussed regarding this finding. A good starting point is to review the buildings that received the highest and lowest scores in the energy efficiency engagement system, and the buildings with the highest and lowest EUIs (which in the case of top scoring building and lowest EUI is one and the same). As a point of clarification, the scores and EUIs are expected to work in opposition – that is, the highest scoring buildings would be expected to perform the best energy-wise, thus having the lowest EUIs, and the lowest scoring buildings would be expected to perform the worst, thus having the highest EUIs.

First, the cooperative building (Building 9) that received the highest energy efficiency engagement score also had the lowest EUI of the seven buildings. This indicates that the some of the hypotheses regarding organizational characteristics in cooperative buildings and the role these characteristics may play in energy consumption are correct to some extent. While it is difficult to discern which of the criteria in this particular property are more important than others in driving the building's low energy consumption, some characteristic or combination of characteristics is helping the building operate efficiently. This property consumes, on average, 25% less energy annually on a normalized per-square-foot basis than an average New York City multifamily property.

Next, the rental properties that received the poorest engagement score in this chapter's scoring system (Buildings 1, 2, and 10) were not the highest consumers of energy, as would be predicted by the system. Instead they were in the mid-range for EUI, with one building consuming more energy. One of these buildings (Building 1) consumed only marginally more than the median NYC multifamily property.

Similarly to Building 1, another rental property that was expected to perform poorly also performed rather well. Building 7, an older rental property, received a fairly low organizational score using the system here; however, it actually was the second best performing property in the set of seven buildings, consuming only 97 kBtu/ft^2 in 2013.

The building consuming the most energy (Building 8, a condominium with a portion of rental units and a source EUI of 259.5 kBtu/f^2) was predicted to perform much better given its score of a 14 on the organizational characteristics. This building consumed at a much higher rate than the average New York City multifamily property, placing it at the very highest end of the consumption spectrum.

We can summarize the findings into three categories as follows: Four buildings were generally accurate in their scoring and associated energy consumption, two buildings performed better than expected, and one building performed worse than expected.

Buildings 2, 4, 9 and 10 were generally accurate in their scoring and associated EUIs. Buildings 4 and 9 received the two highest scores of the seven properties on the organizational criteria and also consumed in the bottom third of energy consumption of the seven properties. Buildings 2 and 10 received low scores on the energy efficiency engagement system and also consumed a fairly high amount of energy – slightly higher than the NYC median EUI in both cases.

Buildings 1 and 7 performed much better than their organizational scoring would have us expect – they were scored to be in the lower half of the organizational system, indicating an expected EUI that was higher than average, but instead performed quite well.

Building 8 performed much worse than expected, scoring very well on the organizational criteria, but consuming much more energy than all of the buildings in the set and much more than the citywide average.

Discussion

The findings above highlight at least a partial mismatch in the building scores earned in this system and their actual energy consumption. A number of points and hypotheses can be discussed in light of this, and some of these may lead to a re-conceptualization of the scoring system.

First, Building 8, which was expected to perform well, actually consumed more energy than all of the other buildings in the sample. The physical characteristics of the building likely come into play: This property is a fairly new glass-façade high-rise building, and was not designed to meet green building standards, which is a likely contributor to its poor performance. Perhaps had it been designed as a LEED or EnergyStar property some of the physical disadvantages of its glass curtain wall could have been counteracted, such as in Buildings 2 and 10, also both new luxury buildings similar in physical design to Building 8 *except* for the fact that they were designed as green buildings. Additionally, as a luxury property Building 8 has a high number of amenities and perks on-site at the building, which consume more energy than standard or moderately designed properties. Also, Building 8 has a hybrid mix of both rental and condominium units; as such, although the property has some element of a resident board, it lacks a true resident-as-organization structure, and it has in conjunction a number of residents who act as customers, thus perhaps overriding the impact this partial resident board may have. As discussed in the previous section, some of the organizational characteristics may carry more weight when coupled together. In the case of Building 8, the high level of luxury amenities coupled with the lack of a true condominium board (because only half of the building is owner-occupied) may be key drivers of the building's poor performance. This is even more heavily weighted when coupled with the physical characteristics of the building described above.

Next, rental properties – such as Buildings 1, 4, and 7 – may perform better than expected for a number of reasons not captured in the scoring system presented here. First, there are physical factors such as building age and construction type (with older buildings tending to perform better in New York City due to thicker and more insulating building envelopes than newer all-glass facades) that may contribute to better performance, despite lack of organizational support for energy efficiency. Building 7, for instance, was built in the early 1900's. Also, economies of scale, especially when the property is very large (as in the case of Building 1 with nearly 500 units), may further contribute to efficiency gains within the building. Additionally, some of the organizational factors captured in the scoring system may have a higher energy efficiency impact when weighted *together* – for instance, Building 4, which performs very well, has the added advantage of being both an EnergyStar property *and* a low-income building (which contributes to lower consumption due to fewer high-end, highly-consumptive amenities on-site).

Finally, and perhaps most importantly, the finding regarding the good performance of Buildings 1, 4, and 7 indicate the need to re-evaluate the role of centralization in rental buildings. In this scoring system, I initially proposed a low score for buildings with a high level of centralization, arguing that decentralized operations that disperse power and decision-making among residents are more likely to result in energy efficiency engagement. However, as evidence presented in Chapter 2 suggests, both decentralization and centralization can be beneficial in a residential building depending on building-specific characteristics and context. In particular, the findings here highlight that when the resident plays the role of a customer, as in most rental buildings, especially when the property is large, some level of centralization and control may be helpful and *even necessary* in order to implement and enforce energy efficiency measures within the building. Thus, a new hypothesis emerges that posits that the score given to a building in this system for level of centralization or decentralization may be dependent on a prior assessment of other building characteristics. To that end, a revision of the scoring system is proposed, wherein groups of the characteristics are hypothesized to hold together (much like a factor analysis). More specifically, it is hypothesized that three characteristics – organizational type, organizational size, and member role – determine if decentralization or centralization is the more beneficial operation for the building. If a building organization is large, operating under a rental structure, and therefore has residents that act as customers, it is likely to benefit more from centralization. Thus, those three characteristics hold together, and the scoring system now becomes tiered, with an assessment of organizational type, size, and member role serving as a baseline step. A revision of the scoring system in this manner is illustrated in Table 3.3.

This revised scoring system can now be used to reevaluate the seven study buildings presented in this chapter in order to determine if their scoring under the revised system more accurately reflects their EUI ranking. The revised building scores are presented in Table 3.4.

Table 3.3 Tiered Energy Efficiency Scoring System

Baseline Evaluation

Building Characteristic	**Criteria**	**Score**
Organizational Type	Rental	1
	Condominium	2
	Cooperative	3
Organizational Size	Large	1
	Medium	2
	Small	3
Member Role	Customer	1
	Stakeholder	2
	Member / Decision maker	3

Total Baseline Score	**Baseline Outcome**
3 to 6	Centralization recommended
7 to 9	Decentralization recommended

Tier One Score

Organization meets centralization/decentralization recommendations?	No	1
	Partially/Somewhat	2
	Yes	3

Tier Two Score

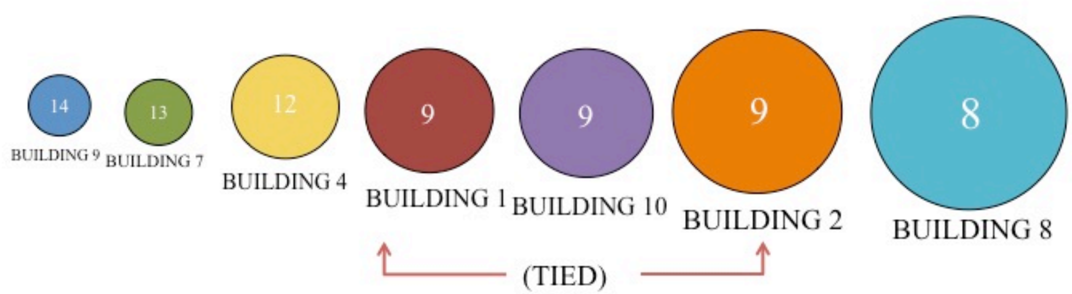
Organizational Goal	Strong economic goal	1
	Balanced economic & social goals	2
	Strong social goal	3
Organizational Boundary	Expansive	1
	Moderate	2
	Contained	3
Resident tenure	Short-term	1
	Medium-term	2
	Long-term	3
Building status	Luxury	1
	Moderate	2
	Standard	3

Table 3.4 Tiered Energy Efficiency Scoring System

Baseline Evaluation														
Building Characteristic	**Building 1**		**Building 2**		**Building 4**		**Building 7**		**Building 8**		**Building 9**		**Building 10**	
Organizational Type	Rental	1	Rental	1	Rental	1	Rental	1	Condo/Rental	1.5	Cooperative	3	Rental	1
Organizational Size	Large	1	Large	1	Medium	2	Large	1	Medium	2	Medium	2	Large	1
Member Role	Customer	1	Customer	1	Customer	1	Customer	1	Customer/ Stakeholder	1.5	Member	3	Customer	1
Total Baseline Score & Outcome	**Recommendation?**													
3 to 6: Centralization recommended ↕ 7 to 9: Decentralization recommended	Centralization	3	Centralization	3	Centralization	4	Centralization	3	Centralization	5	Decentralization	8	Centralization	3
Tier One Score	**Building 1**		**Building 2**		**Building 4**		**Building 7**		**Building 8**		**Building 9**		**Building 10**	
Organization meets centralization/decentralization recommendations?	Yes	3	Yes	3	Mostly	2	Yes	3	No	1	Yes	3	Yes	3
Tier Two Score														
Organizational Goal	Economic	1	Economic	1	Balanced	2	Balanced	2	Economic	1	Social	3	Economic	1
Organizational Boundary	Moderate	2	Moderate	2	Contained	3	Moderate	2	Contained	3	Contained	3	Moderate	2
Resident tenure	Medium-term	2	Medium-term	2	Long-term	3	Long-term	3	Medium-term	2	Long-term	3	Medium-term	2
Building status	Luxury	1	Luxury	1	Moderate	2	Standard	3	Luxury	1	Moderate	2	Luxury	1
TOTAL SCORE	**9**		**9**		**12**		**13**		**8**		**14**		**9**	

Using this revised scoring system, we can re-evaluate if the building EUI's are more accurately reflected by the organizational score presented here. This graphic is presented in Figure 3.3, below. As this graphic represents, the revised organizational score is indeed a more accurate representation of the energy consumption of the properties. Three buildings were tied in their organizational score (Buildings 1, 10 and 2), and these three properties consumed similar amounts of energy (reflected in the relatively similar circle sizes as representations of EUI). In this revised scoring, the three lowest consumers of energy (Buildings 9, 7, and 4) and the highest consumer of energy (Building 8) are now in their accurate placement; these four buildings also received the three best organizational scores, and the worst organizational score, respectively. Thus, these findings highlight the success of the revised system presented here and, more specifically, the increased importance of a more tailored understanding of centralization and decentralization in building operations.

Figure 3.3. Study buildings ordered by revised organizational criteria score
(*circle size reflects EUI)



It is important to also mention of a few limitations and next steps, which lend themselves to further analysis in subsequent chapters. First, although building technology and characteristics (such as building envelope material and building age) are mentioned as important here, there is no way to accurately and truly assess their impact on energy consumption without being able to hold constant these variables in a quantitative statistical analysis. The sample size of seven buildings does not allow for this level of analytical detail here. Thus, the next chapter looks at the full dataset of New York City buildings and attempts precisely this task – it assesses the impact of organizational factors such as ownership type while holding constant physical building characteristics. While this next chapter will lose some of the nuance that is presented here when the buildings are known in good detail from site visits and interviews, it provides an important complement to this work.

Also, the findings regarding Building 9 – the lowest consumer of energy and the highest scoring building on the energy efficiency criteria in both the simple and the tiered versions of the scoring system – are important, and lead to further questions about the organization and operation of cooperative properties. Thus, Chapter 5 takes a more detailed look at Building 5, a very small Brooklyn cooperative building which was listed as a study site in Chapter 1 but not scored in this system (due to lack of energy disclosure data from this property owing to its small size). Although some information is lost by lack of energy data for Building 5 as an observed metric to compare with organizational data, multiple interviews and a building-wide survey were conducted in this building to offer a more qualitative assessment of some of the important properties of cooperatives. This too presents an important complement to the work presented in this chapter and the findings regarding Building 9.

Finally, the work presented in this chapter led to a new hypothesis regarding large rental buildings with residents as customers – namely, that this type of property may require some form of centralization in order to successfully operate in an energy efficient manner. Capacity of the owner organization may matter more in rentals. This hypothesis was initially tested in this chapter by re-conceptualizing the scoring methodology, which led to a system that more effectively and accurately identified energy efficient buildings. In order to explore this further, Chapter 6 offers a comparative analysis of Buildings 2 and 4 – both rental properties constructed to be green or energy efficient, but with very different occupant demographics (Building 2 is a luxury building while Building 4 is a low-income building). Results of the analysis in this chapter indicated that Building 4 performed better than Building 2; Chapter 6 will explore this finding in more detail, allowing for a better understanding not just of each building's energy performance, but of the organizational capacity and occupant socioeconomic status that may play a role as well.

CHAPTER 4
ORGANIZATIONAL DETERMINANTS OF ENERGY EFFICIENCY IN THE NYC BUILDING STOCK

INTRODUCTION

The previous chapter highlighted important findings regarding a cooperative property (Building 9) that was studied and scored using the organizational criteria. It received the highest score on the metrics outlined, and also consumed the least amount of energy, indicating that some of the characteristics assumed to be important in cooperatives do indeed contribute to less energy consumption. The major limitation in that chapter was the small sample size and mostly qualitative analysis.

This chapter takes those findings a step further, and explores whole-building energy consumption in the New York City (NYC) residential building stock by examining energy disclosure data made available under NYC's Local Law 84 (LL84), which mandates owners of buildings over 50,000SF to disclose energy consumption to the city. Although some work has been done on this data by other researchers (See Hsu, 2012, 2014a, 2014b; Kontakosta, 2012), this existing work has centered primarily on understanding the determinants of energy use in buildings. Some more recent work is now focusing on new ways to use disclosure data in cities, issues of energy inefficiency in low-income populations, and determinants of water use in buildings (City of New York, 2014; Kontokosta, 2013, 2014); however, no work to date has explored organizational factors that may be present in buildings in the dataset, or the role of ownership type on energy use. This work takes a deeper look at the disclosure data; it merges it with NYC's PLUTO data, which makes available tax, zoning and owner information, and adds new variables created for this research. Building on the findings in the previous chapter, this section explores the hypotheses that there are underexplored building-level variables that impact energy consumption and, in particular, that ownership type plays a large role.

Disclosure Data as a New Policy Mechanism

A number of cities are exploring disclosure policies as a fairly new regulatory mechanism to increase energy efficiency of the building stock. Briefly, disclosure requirements simply mean that owners of properties (typically over a certain size or of a certain end use type, depending on individual city requirements) are required to annually report their property's energy consumption to the city. To date, New York City, Philadelphia, San Francisco, and Chicago have all enacted disclosure regulations. The intent of this type of regulatory mechanism is that building owners (and the city) will become more aware of the heaviest consumers and major outliers in the building stock.

In New York City, the disclosure requirement arose out of the Greener, Greater Buildings Plan, a 2009 initiative developed by former Mayor Michael Bloomberg as one component of the citywide PlaNYC 2030 sustainability program (City of New York, 2012). The Greener Greater Buildings Plan was developed with the recognition that in order to meet the carbon reduction goals of the city's broader PlaNYC 2030 initiative, new policies must address the C02 emissions generated by building operations. The initiative includes a number of new policies enacted by city council. Local Law 84 – the disclosure requirement – was passed in 2009, and first required building owners to disclose energy data in 2011 (publicly released in 2012). Initially the disclosure requirement pertained only to commercial properties; the policy has since been expanded to include multi-family residential buildings, which have been required to file beginning with year 2 of data collection (2012). Building owners are required to use the

Environmental Protection Agency's Portfolio Manager tool as a mechanism for entering information and generating data about their property's performance.

Although disclosure data is still too new to quantify or determine any citywide energy savings as a result of the requirement, findings thus far have highlighted surprising inconsistencies in the energy performance of some buildings. For instance, some fairly new properties that achieved a high Leadership in Energy and Environmental Design (LEED) rating from the United States Green Building Council consumed more energy than mid-1920's non-LEED properties. This and other similar findings highlighted the need for much further analysis to understand some of the nuanced and contextual factors that contribute to building-wide energy consumption. It also shed light on the immense opportunity for researchers, as the benchmarking data is new, understudied, and rich with information.

Ownership and Energy Use

One area that has not yet been analyzed in the disclosure data is the impact, if any, of building ownership type on energy consumption. There is good reason to think this may be an important predictive variable.

Owner-occupied units reduce or eliminate the principal-agent problem inherent between tenant and landlord in rental properties. The principal-agent problem is a complicating factor concerning energy efficiency in both residential and commercial properties and a number of researchers highlight its role in lack of investment (Ástmarsson, Jensen, & Maslesa, 2013; Kleindorfer et al., 1993; Panayotou & Zinnes, 1994; Prindle & Finlinson, 2011). In residential rental buildings, tenants typically pay individually for their home electricity consumption and have little to no incentive to care about or change building-wide common area behavior or consumption, which is typically paid for by the building owner. Additionally, although residents may care about their individual household electricity consumption, certain determining factors, such as the efficiency of large household appliances in the home (dishwashers, clothes washers, etc.), are out of their control (and they are unlikely to want to make the investment in new appliances, for instance, in a home they do not own or, even more commonly, are restricted from doing so under terms in their lease). Conversely, in situations where common area consumption charges are bundled into the rent and partially paid for by tenants, building owners have little to no incentive to upgrade building-wide infrastructure to be more efficient. Similarly, they have little to no incentive to make individual apartments more energy efficient by installing better appliances or other devices such as smart thermostats if the occupant is solely responsible for the monthly electricity bill. Ástmarsson et al. (2013) conducted interviews to assess the feasibility of a number of proposals in the Danish residential rental sector to address the landlord-tenant issue, such as green leases, building labeling, and other schemes; while programs and regulations such as these are likely to help bridge the gap between incentive and information asymmetries between owner and renter, they are currently given more attention in the U.S. in the commercial sector, and it is unlikely that the current structure of residential leasing and energy payment structures will drastically change in the near future.

In urban multi-family owner-occupied units, however, residents have a direct economic stake in the efficiency and cost of consumption not just of their individual housing unit, but in the building overall as well. Ownership type is therefore likely to be an important factor in determining the overall energy performance of residential buildings in New York City.

New York City also offers an opportunity for a more unique and deeper exploration of this hypothesis. The vast majority of individuals who own their homes in this city (or in any dense city) do not live in single-family structures, but instead occupy one unit within a multi-family building. As such, there is not a single category for "homeowner" in New York and similar cities, but multiple ownership configurations, such as condominium or cooperative, and within these categories exist a multitude of characteristics about number of owners within a building, size and type of cooperative or condominium board, extent of involvement with the board expected by resident, etc. All of these variables are likely to play a role in energy consumption, and point to non-economic organizational factors that may drive energy decision-making and behavior in owner-occupied units.

This chapter explores the hypothesis that ownership type – as the key organizational characteristic of a building outlined in Chapter 2 -- plays a role in overall building energy consumption, and explores this hypothesis by analyzing the New York City LL84 disclosure data along with the City's PLUTO data. It offers a new approach to disclosure data analysis and is the first, to my knowledge, to explore the role of organizational variables such as ownership type on energy consumption.

The remainder of this chapter is organized as follows. First, the method of analysis is described, including the dataset characteristics, research design, samples, key variables, and analytic strategy. Next, the results of the analytic strategy and statistical analysis are described. Finally, a discussion is offered that connects the findings to the initial hypothesis about energy consumption in owner-occupied buildings in New York City, and offers next steps for further research in this dissertation as well as connections to and recommendations for policy.

METHOD

Research Design

This work relies on two datasets for primary analysis. First, the research uses observations at the individual building level from the NYC LL84 energy disclosure dataset from 2013. Additionally, this work uses observations at the individual building level from the NYC PLUTO dataset from 2013. Each of these will be described in more detail.

The New York City LL84 2013 dataset includes 14,777 observations of individual buildings. Of this, 2,302 buildings that were required to benchmark did not provide data to the city. The number of total buildings with data available was 12,475 (observations with missing energy data were dropped). This most recent dataset (the 2013 building data) was made publicly available in November of 2014. This data is collected annually by the City, and requires building owners of properties greater than 50,000SF to use the Environmental Protection Agency (EPA) Portfolio Manager tool to determine annual energy consumption and disclose it to the Department of Finance and Department of Buildings. The dataset includes variables such as building size, greenhouse gas emissions generated, water use, and year built. Property owners of buildings required to benchmark must submit their data to the City by May of each year. The 2013 dataset is the third year of data collected and made available.

The New York City PLUTO dataset, which is made available by the Department of City Planning, includes hundreds of thousands of observations of individual buildings downloadable as spreadsheets by borough (for instance, over 277,000 properties are contained in the Brooklyn spreadsheet alone). The dataset compiles over 70 variables relating to property from data maintained by various city agencies, including block and lot number, assessed value, year built, zoning classification, census block and tract, property type (residential, commercial, mixed use, etc.), number of residential units, number of floors, and many other characteristics.

Although the two datasets together offer a wealth of property information, a number of characteristics that are likely to impact energy use are not made available. These include building construction type (wood frame, steel frame, etc.), mechanical system (central cooling and heating or other), number of elevators, and metering arrangement (sub-metered or not).

Sample, Data, and Key Measures

Sample

This research focuses only on residential buildings; as such, a number of observations were dropped from the full LL84 dataset to generate a sample that contained only multifamily residential properties. Of the 12,475 total buildings in the LL84 dataset, 9,520 were residential and remained as part of the study sample.

The two datasets – the remaining residential properties in the LL84 data and the full PLUTO dataset – were then merged using database software, and queried on a common field – the city's BBL number, a unique identifier for every city property based on a string of numbers that comprises the building's borough, block and lot number. No two city properties have the same BBL and, as such, this variable becomes an important tool for combining and analyzing multiple datasets in New York City.

A number of the remaining residential properties in the LL84 dataset did not have associated PLUTO data. Similarly, of the hundreds of thousands of city properties listed in the PLUTO data, only a small percentage meet the size requirements of the benchmarking regulations. All observations without matching BBL numbers in both LL84 and PLUTO data were dropped (resulting in the removal of thousands of observations).

A number of other steps were undertaken to clean the data. This procedure was informed by existing work done by researchers for the city on prior years' disclosure data (Kontakosta, 2012). Properties that reported an energy use intensity (EUI) of less than 5 or over 1,000 were dropped, as these were deemed inaccurate or faulty entries (Kontakosta, 2012).

A number of PLUTO variables were deemed unnecessary for this work, and were removed from the dataset altogether (these variables included police precinct, school district, fire department, etc.). Any observations with a "residential units" count of fewer than ten were dropped. Similarly, any observations listed as residential properties but with "residential area" reported as zero were dropped. Also, all properties with multiple buildings on a single tax lot were dropped, so as to ensure the total EUI reported was for a single building. In total, 2,606 observations remained after merging the datasets, dropping missing observations, and cleaning the data as described above.

Key Variables

Dependent Variable

This research utilizes site energy use intensity (EUI) as the focal dependent variable of interest. This variable measures whole-building energy consumption and is self-reported by the building owner using the EPA's Portfolio Manager tool. As explained by the City, the site EUI variable is, "The energy use intensity divided by property size, as calculated by Portfolio Manager, at the property site. This equals the amount of energy consumed at the site in kBTUs per gross square foot ($kBtu/ft^2$) (City of New York, 2013). The median site EUI for a multifamily building in New York City in 2012 was 121 $kBtu/ft^2$ (City of New York, 2013).

Additional energy variables exist in the LL84 dataset that are not being used for this analysis. First, source EUI was collected from property owners and added to the most recent 2014 LL84 data. Source EUI takes into account regional and utility supply differences and their impact on energy use. According to the City, "Source energy represents the total amount of raw fuel that is required to operate the building, and it incorporates all transmission, delivery, and production losses from the utility" (City of New York, 2014). Thus, this metric is not appropriate for an analysis that seeks to understand decision-making and consumption at the individual building level.

Additionally, weather normalized site EUI is also collected from property owners. This measure is most appropriate when comparing across years, or when comparing between different parts of the country, as it holds constant seasonal variation year-by-year in building consumption. Since this research makes no such comparison, this variable is also omitted.

Independent Variable(s)

New independent variables were created for purposes of this analysis. In particular, this work is interested in ownership type. To create ownership variables, this research relied on the building class ("*bldgclass")* variable in the city's PLUTO data, which identified the usage type of all properties with a two-digit alphanumeric code. For instance, the H1 category identifies luxury hotels built prior to 1960, and the K3 category identifies multi-story department stores. In total, 25 distinct alphabetic category types exist (letters A-Z, except for X), with multiple numeric usage types within each category (0-9, with letters used for categories with more than 9 usage types). For purposes of this work, the goal was to use this categorization system to identify rental buildings, condominiums, and cooperatives. To that end, the primary categories of interest include those identified in Table 4.1.

Table 4.1

Building usage types	**City code**
Walk up apt: Over 6 families	C1
Walk up apt: Old law tenemant	C4
Walk up apt: Cooperative	C6
Walk up apt: Over 6 families	C7
Walk up apt: Cooperative conversion	C8
Elevator apt: Cooperative conversion	D0
Elevator apt: Semi-fireproof	D1
Elevator apt: Artists in residence	D2
Elevator apt: Fireproof (no stores)	D3
Elevator apt: Cooperative	D4
Elevator apt: Converted	D5
Elevator apt: Fireproof (with stores)	D6
Elevator apt: Semi-fireproof (with stores)	D7
Elevator apt: Luxury	D8
Elevator apt: Misc	D9
Hotel: Apartment hotels	H6
Hotel: Apartment hotels/co-op owned	H7
Hotel: Dormitory	H8
Condo: Apartment/elevator residential unit	R4
Condo: Condop	R9
Condo: Mixed residential condo building	RD
Condo: Mixed residential & commercial	RM
Condo: Mixed residential, comm. & industrial	RX
Condo: Mixed residential & warehouse	RZ

New Variables	**Applicable City Code(s)**
Rental	C1, C4, C7
	D1, D2, D3, D5, D6, D7, D8, D9
	H6, H8
Cooperative	C6, C8
	D0, D4
	H7
Condominium	R4, R9, RD, RM, RX, RZ
Luxury rental	D8, H6

This work also further parsed out the rental category to differentiate between two sub-categories of rental housing types: public housing properties (which are not listed as a distinct alphanumeric category in the *bldgclass* variable discussed above) and luxury rentals. To generate the public housing variable, this research relied on two PLUTO data metrics. First, it used the owner type variable ("*ownertype")* to determine which properties are city or authority owned. Within those properties, it then made use of the owner name field (*"ownername")* to identify properties owned by the New York City Housing Authority (NYCHA) or other known affordable housing developers/managers.

To generate the luxury housing variable ("*luxury")*, it made use of the category D8 in the usage categories described above, which identifies luxury elevator rental buildings in the dataset. See Table 4.2 for a summary of the public housing and luxury rental data.

Finally, this research was also interested in finding a metric to determine overall building quality or value relative to other properties. To that end, it used the PLUTO variable for assessed value, which is generated by the New York City Department of Finance by multiplying the estimated market value by a percentage for the property's tax class (City of New York, 2013).

Control Variables

A number of control variables were included in the sample dataset to ensure that building characteristics were held constant during analyses. These variables included the year the property was built as recorded by the Department of Finance, which was transformed into an ordinal variable (*bldgage)* with four categories of building age (pre-1925, 1926-1975, 1976-1999, and 2000-present); the self-reported property square footage (*sqft*), measured as a continuous variable and recorded by the EPA Portfolio Manager as entered by the property owner in the LL84 data collection process; the number of residential units (*unitsres)*, measured as a continuous variable as the sum of all residential units on the tax lot as recorded by the Department of Finance; the number of floors (*numfloors)*, measured as a continuous variable indicating the number of stories on the property including the ground floor, as recorded by the Department of Finance; the residential floor area ratio (*residFAR*), measured as an interval variable ranging from zero to ten, as reported by the Department of City Planning; and the lot area, measured as a continuous variable indicating total SF on the tax lot.

One additional variable not included here that would offer an important complement to those mentioned above is some measure of an average energy price variable. This should be incorporated into future regression analyses, and could either be included directly (if available), or generated using energy expenditure data coupled with energy consumption data, or generated as a weighted average energy price using utility rates if the mix of fuels is available for each building. Higher energy prices would be expected to have a negative effect on energy consumption, and would ideally also be included as a control variable.

Summary Statistics

For a summary and descriptive statistics of all key variables mentioned above, please see Table 4.2.

Table 4.2. Descriptive Statistics

Descriptive Statistics: LL84 and PLUTO Analysis					
	n	**Mean**	**SD**	**Min**	**Max**
Dependent variables of interest					
Site EUI	2606	85.5	40.3	5.4	756.3
Focal independent variable(s)	n	Yes	No	%	
Cooperative (0/1)	2606	999	1607	38%	
Condominium (0/1)	2606	438	2168	17%	
Rental (0/1)	2606	1169	1437	45%	
Luxury property	2606	58	2548	2%	
~~Public housing~~	~~2606~~	~~122~~	~~2484~~	~~5%~~	
		Mean	SD	Min	Max
Assessed value	2605	$ 12,700,000	$ 14,800,000	$ 481,950	$ 150,000,000
Control variables	n	Pre-1925	1926-1975	1976-1999	2000-Present
Building age	2606	256 (9.2%)	1784 (68.5%)	291 (11.2%)	275 (10.6%)
	n	Mean	SD	Min	Max
Number of residential units	2606	176	138.5	12	1689
Self-reported building area (SF)	2606	221450	182330	22033	2035745
Number of floors	2606	16	10	1	78
Residential FAR	2606	5.88	3.39	0	10
Lot area (SF)	2606	40385	61578	5020	1317803

Analytic Strategy

Multivariate linear regression analysis was used to determine the role, if any, of organizational variables such as owner type on outcomes for building-wide energy consumption. The dependent variable of interest for this research – site EUI – is an interval level continuous variable; as such, parameters were assumed to be linear, and Ordinary Least Squares (OLS) was employed for estimating all models.

Multiple regression models were run for this analysis. An initial base equation included only basic building characteristics; subsequent models added in additional variables to tease out new relationships while holding constant potentially influential building characteristics.

RESULTS

In total, four regression models were deemed useful for this research. This section will discuss main findings and highlights from these models. Results of all regression equations can be found in Table 4.3.

Statistical Significance

In Model 1 (the base model), which included only building characteristics as independent variables, the following variables returned significant variables at the 95% ($p<0.005$) or 99% level ($p<0.000$): Building age, square footage, number of floors, number of residential units, and residential FAR. The variable for lot area returned a moderately significant variable at the 90% level.

In Model 2, the variable for rental properties was added as potential predictor of building EUI. In this model, results for control variables were similar to those found in Model 1: Building age, square footage, number of floors, and residential FAR were all significant at the 95% or 99% level. Lot area was again moderately significant at the 90% level. In this model, there was no statistical significance found in predicting site EUI from number of residential units. The addition of the variable *rental* proved fruitful; it returned a significant coefficient at the 95% level ($p<0.005$), indicating that rental properties consume more energy, holding all else equal, than non-rental properties.

In Model 3, variables for luxury properties, public housing, and assessed value were added to the variable for rental properties (along with all base model control variables). Results of this model indicate that public housing is a highly significant predictor of energy consumption. The variable is significant at the 95% level ($p<0.005$); in addition, the coefficient is very large in magnitude, indicating a significant impact of this variable on site EUI. In this model, significant control variables included, again, building age, square footage, number of floors, and residential FAR. Number of units of residential was moderately significant at the 90% level.

In Model 4, variables for condominium properties and cooperative properties were added to the base model. In this analysis, it was found that cooperative properties show a statistically significant decrease in site EUI, holding all else equal; this variable is significant at the 95% level. The variable for condominium properties was not statistically significant. Control variables that returned significant coefficients included building age, square footage, number of floors and residential FAR. Lot area was moderately significant at the 90% level.

Direction of Coefficients

Some findings can be highlighted regarding the directionality of coefficients. A surprising finding is that building age and building size both correlate in a negative direction with site EUI, indicating that older and larger buildings tend to perform better than newer and smaller buildings. Although this may seem counterintuitive at first glance, it is in keeping with other analyses of the LL84 disclosure data, by the city and others (see City of New York, 2012; Kontakosta, 2012). These and other reports have found that older buildings tend to perform better than newer buildings, in part due to styles of construction and building materials used. In addition, Kontakosta (2012) found that larger buildings performed better than smaller buildings. He attributes this in part to economies of scale in building systems; this is indicative of a larger trend that needs further examination. Number of floors and number of residential units returned positive coefficients, as expected, indicating that taller buildings and those with more households consume more energy.

Finally, rental buildings and public housing returned positive coefficients, while condominiums and cooperatives returned negative coefficients, indicating that, holding all else equal, public housing and rental buildings consume more energy and condominium and cooperative buildings consume much less than other multifamily buildings in New York City (keeping in mind, however, that the *condominium* variable was not statistically significant, despite its negative direction).

Model Fit

The overall model fit of all five regressions is low, with R^2 values ranging from approximately .03 to .04, indicating that the independent variables in the models explain only approximately 3-4% of the variation in the dependent variable. However, the models all returned F-statistics for each overall model of $p<0.000$.

Comparison Models

Due to the low R^2 values reported in the previous section on the 4 regressions discussed here, models were run again using a modified version of building energy use. Instead of using kBtu/ft^2, as reported by the city and EnergyStar portfolio manager, this modification made use of a new variable for total building energy use. This figure was not normalized by square footage of the building. Results of these regressions indicated significantly higher R^2 values (for instance, Model 1's R^2 increased from .0287 to .7670). The direction of coefficients remained the same in all 4 models using the new energy variable. Some independent variables gained or lost statistical significance. For instance, building age and number of floors were no longer significant in Model 1 using the new energy variable, while reported SF, units of residential, residential FAR, and lot area all increased in significance. Although the increase in R^2 values is beneficial, most studies employing disclosure data rely on the normalized per-square-foot figure. Thus, this chapter will discuss findings in regards to the models using that number, so that it can be more easily compared to reports by the city and other work using this data, but it is important to note that additional models were run, and they were fruitful in increasing the R^2 values.

DISCUSSION

The findings in Models 1-4 highlight significant and understudied variations in energy performance in multifamily residential buildings in New York City based on ownership type. In particular, rental buildings and public housing properties consumed more energy, while cooperatives consumed significantly less energy. A few points can be made regarding these findings.

First, public housing properties were also found to be poor performers in previous reports (Kontakosta, 2012). This is indicative of a serious neglect of building systems and efficiency in public housing, which means the city's most vulnerable residents are also those living in the most energy inefficient properties. In addition, from an occupant perspective public housing units lack price feedback systems and have very poor building control systems. For example, residents often lack thermostat control, so must rely on opening windows in winter if they are too hot. Over the span of the entire public housing portfolio, these inefficiencies lead to incredibly wasteful building operations.

From an organizational perspective, Peter Senge (2010) distinguishes between what he terms "learning organizations" and organizations that aim only for mediocrity; he argues that organizations are systems and, as such, "When placed in the same system, people, however different, tend to produce similar results" (p. 53). The research presented here can extend this line of thinking to the findings regarding public housing. The system boundary in the public housing scenario can be drawn around the many hundreds of city housing authority properties across the five boroughs of New York City. Within this larger system, the organizational unit of analysis is the City; although individual buildings may have characteristics that differentiate them from one another, decisions about building operation, property investment, and routine maintenance are made by the larger housing authority and employees of this agency that are on-site at different properties. Little room exists for innovation, creative thinking, and the flexibility to take risks at the individual building or individual agent level.

Rental properties, cooperatives, and condominiums have yet to be studied in other reports, making them unique to this research. Organizationally, in large rental properties (both luxury and not) individual residents and households are usually viewed as customers of the organization, not stakeholders or decision-makers. Renters expect a certain level of services in the building in exchange for rent paid each month, and economically have little incentive to care about things occurring outside of their apartment walls (the boundary of their financial stake in the property). As such, the split incentive issue arising out of principal agent misalignments becomes particularly relevant in rental properties. In addition, rental properties have a unique tension between decentralization and centralization. While decentralization is generally advocated for as a good thing in buildings (and organizations more broadly), it is unclear if dispersed power and decision-making would be helpful or even desired in rental properties given other organizational characteristics. Additionally, defining centralization versus decentralization in rental properties is challenging. Most large management companies own multiple properties but, as explained in the organizational typology in Chapter 2, a decentralized portfolio should not be interchanged with a geographically dispersed portfolio. Even geographically dispersed buildings owned by the same entity may have highly centralized individual building operations, and this may benefit the individual property.

The findings indicating that owner-occupied units perform better than non owner-occupied units are not surprising; as noted previously, principal-agent misalignments can be diminished in owner-occupied units. However, within owner-occupied units, cooperatives perform better than condominiums (and returned statistically significant results to this end). This finding is surprising, but in line with the organizational expectations and hypotheses arrived at in previous chapters. It indicates unique organizational dynamics occurring within cooperative buildings. More specifically, the level of centralization that exists in rental properties and public housing does not exist to the same extent in most cooperatives; the organizational hierarchy tends to be much flatter, as individual residents play key roles as cooperative board members in deciding how the building will be managed and operated. The residents are no longer customers of the organization, but members.

Senge elaborates on organizational thinking in a way that is helpful here, pointing to three perspectives organizations can take to better understand things that occur (Senge, 2010). The first perspective, "event" explanations, focuses only on what happened and why; these reactive types of explanations do little to advance an organization's learning (Senge, 2010). The second type, "pattern of behavior" explanations, begins to look at longer-term trends within the organization as explanations for why things occur. Senge argues that these explanations are responsive, which is an advance from a purely reactive stance. Finally, an advanced organization can take a structural stance to understanding why things occur; this powerful approach, according to Senge, is generative. It is the only explanation of the three that sets out to understand underlying patterns of behavior and change existing patterns.

I hypothesize that rental properties and public housing properties rest on the spectrum between reactive and responsive approaches to outcomes and events, while cooperative properties rest on the spectrum between responsive to generative. This occurs primarily because of levels of centralization in rental properties and public housing that prohibit individuals from being able to view and understand the entire structure and system of the organization; the ability to be generative rests, in part, on the ability to see the structure.

Not all buildings will follow this organizational hypothesis; context matters. Additionally, the findings presented here support the hypotheses mentioned above regarding cooperatives, but do not rule out alternative explanations; therefore, a switch to a mixed methods case study of a small cooperative building will help better explain some of these outcomes. This case study will be explored in the next chapter. Further, some measure of energy pricing should ultimately be included in regression models, as mentioned in the methods section. Although not available for this research, this points to a future research agenda that would strengthen the analyses here. Finally, rental buildings need further analysis; a subsequent chapter will explore two rental properties – one luxury and one affordable – to better understand the drivers of behavior within these types of organizational structures, and if the role of centralization and decentralization has different impacts in these types of buildings.

Table 4.3
Results of Regressions of Site EUI with Owner and Building Characteristics

Dependent Variable: Site Energy Use Intensity (EUI) kBtu/SF

Regressor	**1**	**2**	**3**	**4**
Bldg Age	-3.2360** (1.0971)	-3.5169** (1.0994)	-3.1864** (1.1240)	-4.1366*** (1.1598)
Reported SF	-.00002** (6.89e-06)	-.00002** (6.88e-06)	-.00003*** (7.59e-06)	-.00002** (6.88e-06)
Number of floors	.6418*** (.1188)	.6943*** (.1189)	.6903*** (.1261)	.6633*** (.1202)
Number of Residential Units	.0257* (.0093)	.0213 (.0094)	.0272* (.0098)	.0219 (.0094)
Residential FAR	-1.3120*** (.3023)	-1.2404*** (.3028)	-1.2701*** (.3124)	-1.2313*** (.3027)
Lot area	.00005* (.00002)	.00005* (.00002)	.00004 (.00002)	.00005* (.00002)
Condo				-1.9500 (2.4263)
Cooperative				-6.1716** (1.7933)
Rental		4.9446** (1.6368)	4.1487 (1.7089)	
Public Housing			13.5320** (4.2756)	
Luxury Rental			-6.2125 (5.5936)	
Assesed Value			2.63e-08 (9.19e-08)	
Model Summary Statistics				
F-statistic & (P-values)	12.81 (0.0000)	12.32 (0.0000)	9.78 (0.0000)	11.14 (0.0000)
R-squared	0.0287	0.0321	0.0363	0.0332
n	2606	2606	2605	2606

**** Indicates individual coefficient is statistically significant at the 99% level*

*** Indicates individual coefficient is statistically significant at the 95% level*

** Indicates individual coefficient is statistically significant at the 90% level*

CHAPTER 5
COOPERATIVE BUILDINGS AND ORGANIZATIONAL CHARACTERISTICS: A CASE STUDY OF DECENTRALIZATION

INTRODUCTION

Chapter 3 findings indicated that a cooperative building study site in Brooklyn (Building 9) performed very well energy-wise relative to the other 6 buildings in the sample, and this property also scored very high on the energy efficiency engagement criteria developed for this research. In support of this finding, Chapter 4 highlighted unique disclosure and benchmarking data findings that point to better energy performance *citywide* in cooperative buildings relative to other types of multifamily residential buildings in New York City. This chapter seeks to better understand some of the specific traits and characteristics that might contribute to and drive this finding in co-op buildings by taking a closer look at a small cooperative building in Brooklyn (Building 5) that provided a good site for a detailed case study. Although full-building energy data was not available for this building because it is under the city's 50,000 SF size requirement for LL84 benchmarking, it is a small, close-knit building, and allowed for a full-building survey and multiple resident interviews, which provided good insight into the workings of this property.

This chapter will begin with a brief review of existing literature and findings regarding cooperative buildings as an ownership structure, and any implications of this on energy consumption. It will then review the methodology for conducting research in this case study building, results of this fieldwork and data collection, and will end with a discussion regarding implications of these findings and any insights about cooperative buildings.

Owner-Occupied Urban Housing Units

Owner-occupied urban housing units as a residence choice can be traced back to the late 1800's and have historically been (and continue to be) particularly popular in New York City (Low, 2012; Low, Donovan, & Gieseking, 2012; Rosen & Walks, 2013). In the middle of the 20th century, cities across the United States saw a wave of flight to the suburbs, but in more recent years urban living has once again become desirable, and residents are making choices to purchase homes in multifamily buildings (Rosen & Walks, 2013). The perception of "urban multifamily building" has also changed; this property type is no longer viewed as a choice for less stable or low-income individuals (Rosen & Walks, 2013). Indeed, very wealthy residents call this type of housing unit home in some of the most expensive cities across the country and world like New York, Hong Kong, San Francisco, and Tokyo.

There are a variety of legal structures that owner-occupied properties can take, which often vary across countries. These can include condominium, cooperative, common interest development (CID), and homeowner association. Although legal specifics vary, the similarity among all structures is that they serve to form some type of collective public-private ownership and governance with shared decision-making or board representation (Low et al., 2012; Rosen & Walks, 2013).

The effects of homeownership on individuals and society have been widely studied. Blum & Kingston (1984) cite evidence from a range of studies between the 1950's and 1980's that support arguments that homeowners participate more in local politics, engage more with neighbors, and are less mobile than renters. There is also some evidence of positive spillover effects in "mixed tenure" developments, where owners and renters share buildings or are co-located in the same neighborhood (Casey, Coward, Allen, & Powell, 2007). However, that argument rests on the assumption that renters are "disadvantaged" and can therefore benefit from the intangible positive social and community externalities that typically come along with owner-occupied homes. In expensive neighborhoods in places like New York City, many very wealthy individuals *choose* to rent, and do so in very high-end luxury properties, and so this may not always hold true.

According to Rosen and Walks (2013) these structures are described as forms of "club" ownership, and can be an effective way of dealing with free rider problems arising from public goods consumption in multifamily buildings. They explain that this ownership form is characterized by "the ability to collectively but exclusively consume housing goods and services among a distinct group of residents, while excluding the general public" (p. 162). Rosen & Walks (2013) also cite condominiums as a transformative urban housing type, responsible in part for shifts in urban areas from neighborhoods of primarily renters to mixed tenure, high-density developments where individuals have stronger levels of engagement and collective responsibility for shared spaces. These homeowners also greatly benefit from tax abatements and policies promoting home ownership, which are heavily supported by U.S. political models (Hansmann, 1991; Rosen & Walks, 2013). Condominiums as an urban housing type have been particularly impactful in Vancouver, where they have heavily increased the density of home-ownership in the city (Harris, 2011).

Cooperative Buildings as Organizations

Condominiums and cooperatives share many characteristics of governance and legal structure, but cooperatives are a unique and distinct form of ownership, and pre-date condominiums in the United States (Hansmann, 1991; Low et al., 2012; Rosen & Walks, 2013). New York City is the only metropolitan area in the U.S. where cooperatives exceed condominium units (Rosen & Walks, 2013). Low (2012) reports data stating that over 80% of all U.S. co-ops are located in New York City. Low et al. (2012) provide a clear explanation of the legal governance and ownership structure that distinguishes cooperatives from condominiums:

> In co-ops, residents become members of a corporation or limited partnership that collectively owns an apartment building or group of houses. Residents become shareholders and purchase shares that entitle them to a long-term "proprietary lease." Individual shareholders do not "own" their units, but own a percentage of shares within the co-op. Condominiums, on the other hand, are real property, with fee simple (individual) ownership of the house or apartment, and common ownership of facilities, land or buildings. Fees covering maintenance, taxes, and improvements are distributed to all residents in both organizations (p. 281).

Cooperative buildings are legally structured as corporations and governed by a board comprised of residents and owners, with governance conferred based on shares owned (Hansmann, 1991; Low et al., 2012; Rosen & Walks, 2013). Although condominiums also have a board governance system to manage building finances and common area repairs and maintenance, cooperatives typically have more legal power and responsibility because they collectively own the entire building, not just common areas (Hansmann, 1991; Low et al., 2012). The corporation structure in both ownership types also lessens legal liability on the board and residents.

Cooperatives can also be distinguished from condominiums by their buyer selection and acceptance process, in which the board serves a strong role as "gatekeeper."

In cooperative buildings, all sales and purchases must undergo approval by the board and all potential buyers and incoming residents must undergo thorough financial, professional, and personal checks. Although legally cooperatives cannot discriminate against qualified buyers based on any non-financial characteristics, Low et al. (2012) explain that cooperative boards need not ever provide any explanation for reasons for rejection of a potential buyer. Thus, cooperative buildings are much more tightly controlled and "exclusive" residential structures. In part because of this tightly-controlled entry, Low et al. (2012) provide evidence from interviews with residents of both cooperative buildings and gated condominium developments that cooperative residents tend to report higher feelings of safety and security in their buildings.

Many of the operational attributes and legal features described above are the defining characteristics of co-ops as organizations and, as such, the primary interest of this work. As stated previously, since we have already established that existing evidence points to cooperative buildings as lower energy consumers, this chapter attempts to qualitatively define and understand some of the subjective social principles at work in these types of buildings. The following sections elaborate on this investigation.

METHOD

Site

The physical site for this case-study research is a small cooperative building located in the Prospect Heights neighborhood in the borough of Brooklyn in New York City. It is located just two blocks away from Grand Army Plaza and the northern entrance of Prospect Park, along with amenities such as the Brooklyn Museum of Art and Brooklyn Botanical Garden. The property was built in 1909 and is a pre-war brick-exterior multi-family walk-up building with 16 residential units and 4 floors. The building contains a mix of two- and three-bedroom units. The property is approximately 13,000SF and also contains a shared basement facility with laundry and storage, and a shared backyard with outdoor amenities such as a grill, seating, and children's toys. The building does not have a centralized ventilation system for heating and cooling; heat is provided by natural gas (after a switch from oil approximately 3 years ago), and residents rely on window air conditioners during summer months. The property converted from a rental to a cooperative building in 1988. To protect resident privacy, the address of the building will remain anonymous, and this property will continue to be referred to as Building 5.

Methodology

A survey was conducted building-wide during January 2015 via an online website link that was circulated to residents by a board member on their online Google message board portal (so as to ensure that all resident emails remained private during this data collection process). The survey consisted of three parts and a total of 21 questions; it took approximately 5 minutes to complete. The survey remained open for a three-week period from January 1, 2015 through January 22, 2015. All adult residents of the cooperative building (24 individuals) were invited to take the survey (even those from the same household), and 12 responses were received (50%). Residents were offered the chance to enter a drawing for one $50 Amazon gift card for completing the survey in full by entering their email address on the last page of the survey (which was not connected to individual survey responses).

The three parts of the survey covered three different sets of questions. Part A consisted of a set of questions about the occupant's perception of and opinion about the building, their neighbors, and the cooperative board. Part B consisted of questions about the respondent's energy and environmental opinions in the building and their household. Part C asked respondents for information about their demographics. The full survey instrument is provided in Appendix B.

Although twelve responses is an admittedly low number and does not allow for robust statistical analysis, given the size of the building, this 50% response rate represents a good portion of the residents, and still provides valuable insight in to their interactions with one another and the cooperative board.

In addition to the building-wide survey, three in-depth (1 to 2 hour) interviews were conducted. Two were conducted with the same current resident (the first about her opinions and experiences in the building more broadly, and the second follow-up interview concentrating on her time as prior years' board president and vice-president), and one was conducted with the long-standing (25+ year) board treasurer who was one of the original sponsors of the cooperative conversion. These interviews were conducted between May and July 2014. The interview protocol is provided in Appendix A.

Participants

The building houses 16 apartments, of which two remained low-income rent-controlled rentals on the 4th floor after the cooperative conversion in the 1980's. One of the original sponsors of the co-op conversion still owns these two units, and one of the residents of these apartments is the granddaughter of the original tenant. In addition, residents elected to retain one basement unit as a market rate rental to generate additional income for the building instead of this unit being used as an on-site superintendent residence. In total, the building houses 27 adult residents, of which 24 are owners of the remaining 13 cooperative units. The co-op board is comprised of 5 members. The board has full voting power for all on-site decision-making, and votes must be majority (not unanimous) in order to enact new policies or implement new initiatives. Any resident in the building is welcome to suggest ideas. The board meets offsite at Interviewee B's law office in Manhattan.

The building is comprised of young, well-educated professionals with above-average incomes. Interviewee A explained that residents include movie producers, artists, and people who work for nonprofits. Of the twelve survey respondents, eleven were between the ages of 30-39 (with the remaining resident reporting their age as between 40-49). Only two respondents (18%) reported an income below $100,000, and one reported an annual income above $300,000. The remaining respondents were evenly split, with 4 reporting annual incomes between $100,000 and $199,000 and 4 reporting annual incomes between $200,000 and $299,000. Gender was nearly even, with 7 male respondents and 5 female respondents. Most respondents (50%) reported a household size of two people, but responses ranged between one and four residents. Anecdotally, it was reported in interviews that many owners currently have small children or often have children after purchasing in the building. All twelve respondents (100%) reported their political orientation as somewhat or very liberal. All respondents reported either a bachelor's or master's degree, with 42% holding a bachelor's degree and 58% holding a master's or other advanced degree. Residents were not asked to report race or ethnicity on the survey, but anecdotally it was reported in interviews that nearly all cooperative owners were white while the residents of the two rent-controlled units were black.

Of the interviewed individuals, Interviewee A is a female in her mid-30's who has lived in a 2-bedroom unit in the building with her husband and dog for approximately 3 years. She works for the City of New York, and in two of the three prior years of her residence has served as both president and vice-president of the board. Interviewee B is a male in his mid-60's who owns the most shares in the building and has been the board treasurer for nearly 3 decades. He was one of the original sponsors of the co-op conversion, and he is a lawyer.

Analytical Approach

The goal of this analysis is to provide a more in-depth understanding of the day-to-day interactions, social relationships, operations, and decision-making of a real New York City cooperative building. This chapter provides a more ethnographic study of the individual lives of some of this particular building's residents in order to provide a case-study snapshot of this cooperative.

In particular, this chapter explores the hypothesis that cooperative buildings, by nature of their ownership configuration and board governance, are more decentralized than other forms of ownership in New York City. In turn, I argue that this leads to a greater level of transparency, proximity to decision-making, and perceived control among members of the organization. I believe these characteristics contribute to a higher likelihood of energy efficiency engagement in the building. These hypotheses will be explored using a combination of survey and interview data.

Because of the small sample size, the analysis of data collected in this building is mostly qualitative, and results will be reported as descriptive statistics with narrative content from the three interviews added to triangulate and support survey findings.

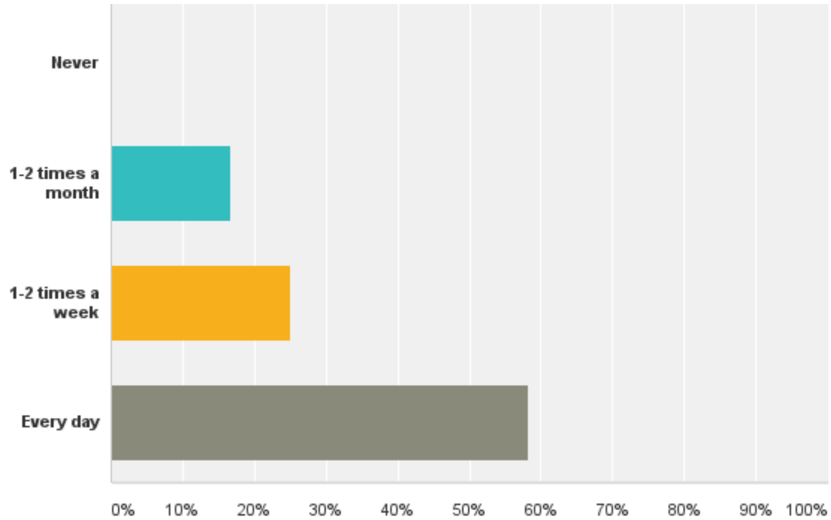
RESULTS

Building Findings

Tenure in the building is generally steady, and residents are not highly transient. Nine out of twelve respondents have lived in the building for 3 or more years, with 5 respondents reporting their tenure at 5 years or longer. Only two of the twelve respondents have lived in the building less than a year. However, both interviewees reported a fairly high amount of turnover because many young families outgrow their apartments in the building after a few years of ownership. Interviewee A explained, "I think it's a very family-friendly building, all of the apartments in the back have 2 bedrooms, so people can start families here, but then they move out. If we had a kid, we couldn't be here very long." Interviewee B explained, "The (Building 5) situation is that it's most people's first purchase, so you know, kids come along, kids get bigger, then they're looking for a bigger place. But, you know, it tends to be people of a similar outlook, and they're interested in the wellbeing of the building and keeping costs down. Hopefully there's some carryover (on the board) and you get more people like (Interviewee A)."

Most respondents reported a high amount of interaction with their neighbors. Seven respondents (58%) reported daily interactions with other residents, and 3 reported interactions once or twice a week. Only 2 respondents reported interaction with other residents 1-2 times a month, and zero respondents reported that they never interact with other residents. See Figure 5.1.

Figure 5.1. Reported Level of Interaction with Neighbors



Residents answered a set of seven questions that attempted to assess their opinions about the strength of the relationships formed in the building and their sense of belonging and inclusion. Answer choices for all seven questions were organized along a Likert scale with five response categories ranging from strongly agree to strongly disagree. See Table 5.1 for a list of all seven questions and the survey results reported by residents on this section.

Results indicate that nearly 83% of respondents (10 respondents out of 12) reported that they have formed at least one close friendship in the building, while all twelve respondents reported that they have formed casual friendships or acquaintances with many residents in the building. Two-thirds of residents (8 respondents) agreed or strongly agreed that the building helps facilitate getting to know neighbors. Three residents disagreed with this statement. Nine out of 12 respondents agreed or strongly agreed that they felt a sense of belonging in the building. Interviewee A reported a number of close friendships in the building, explaining that two other couples in the building have spare sets of her keys, and that they often do things together as couples. She also explained that the building has weekly Sunday backyard gatherings in warmer months where any resident who is available and wants to join can come hang out in the backyard with a bottle of wine.

The final three questions in this set asked respondents if they agreed or disagreed that they were *aware* of decisions made in the building, *included* in the decision-making in the building, and that their opinions about decisions mattered. Responses to these questions were more evenly dispersed across the strongly agree to strongly disagree spectrum.

Table 5.1. Resident Assessments of Strength of Relationships and Belonging

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
I have formed a strong friendship with at least one person in the building	41.7% (5)	41.7% (5)	0.0% (0)	8.3% (1)	8.3% (1)
I have formed casual acquaintances with many residents in the building	58.3% (7)	41.7% (5)	0.0% (0)	0.0% (0)	0.0% (0)
My building encourages me to get to know my neighbors through social activities, shared spaces, projects in and around the building, and other on-site activities	33.3% (4)	33.3% (4)	8.3% (1)	25.0% (3)	0.0% (0)
I feel a sense of connection and belonging in my building	50.0% (6)	25.0% (3)	0.0% (0)	16.7% (2)	8.3% (1)
I am aware of discussions that are made for/about my building by the co-op board	41.7% (5)	33.3% (4)	0.0% (0)	0.0% (0)	25.0% (3)
I am included in the decision-making of the building	16.7% (2)	16.7% (2)	16.7% (2)	25.0% (3)	25.0% (3)
My opinion matters in the decision-making of the building	16.7% (2)	41.7% (5)	16.7% (2)	8.3% (1)	16.7% (2)

When asked how important their social relationships in the building were relative to social relationships outside of the building, half of the respondents (6 occupants) reported that their social relationships in the building were just as important as those outside of the building. Half reported these relationships were less important. None reported that the relationships in the building were more important.

Of the twelve respondents, 5 had served on the board at some point during their tenure in the building, while 7 had not. All respondents reported knowing their board members either a little or very well. No respondents reported wanting less input in the decision-making of the building than they currently have. Seven respondents reported they are satisfied with their current amount of input in the building, and 5 reported they would like more input.

Interviews with the former and current board member helped add additional detail to the workings of the board and residents. In Interviewee A's follow-up interview about her time as board president and vice president, she explained that the monthly maintenance price every resident must pay – which supports functions like common areas, superintendent, and supplies – is based on number of shares owned. She pays approximately $700 per month. Those with more shares (based on square footage) pay a higher monthly co-op fee. Common areas include the basement bike room, storage space, laundry room, backyard (which has lights and cameras), front yard (which is rarely used), and hallways. Laundry machines are reduced but not free, and money from those machines is added into the building's operating account, which is used to purchase light bulbs, gardening supplies, and other necessities. When asked who purchased those necessities she replied, "Whoever. If you notice it, you can buy it. You just submit your receipt and get reimbursed. Or you can tell the super. He has an account at Home Depot for our building."

Interviewee A explained that Interviewee B has always been the board treasurer; he must be voted into that role each year, but people always vote for him. His long-standing tenure on the board as the treasurer means that, to non-board members, "He sets what are seemingly arbitrary rules. But people don't understand that if he leaves it would be so much harder." As treasurer, he pays the electricity bills for the common area spaces. In addition to Interviewee B, one other long-standing resident ("Rosie") always sits on the board, and has lived in the building since the 1940's. It is often the case according to Interviewee A that board decisions come down to Rosie and Interviewee B "against the young people" on the board.

Interviewee B explained his decades-long role in the building: "Myself and three other people were the sponsors of the conversion to co-op. Of those 4, one died, and another walked away from his interest. This was in about 1990 when the real estate market was in really poor shape. Since he left, the management fell to me. And I've been involved in varying degrees since then. There were 3 owner-occupants when I got involved in the building. Five of the 16 apartments had been sold. And the owner occupants, with the exception of one person, were not active in the building. So, the management of it, since we owned 11 apartments, by default the management fell to me."

Entry into the building requires a full board packet with 6 months of financials and bank statements along with references. However, the board has not rejected anyone in the last 10 years. According to Interviewee A, "the biggest time suck of being a board member is dealing with people complaining." She said of her time as a board member, "It was so much work. Everyone has something to complain about. People treat us like a management company."

Interviewee A discussed tense feelings between the original rent-controlled tenants and the newer families purchasing cooperative units. She explained that the neighborhood is changing quickly, and there is still a fundamental clash between the “gentrifiers” and the “originals” in the neighborhood. Installing cameras in some areas of the building, for instance, was a very contentious initiative. When asked to discuss the biggest challenge in the building, Interviewee B explained, “One of the problems, and maybe it’s the main problem, is that not only do you have owners, but you have rent-regulated tenants here, and they can be difficult. And there’s nothing you can do about it.”

Energy and Environmental Findings

Exactly half of the respondents (6 respondents) reported that they try to conserve energy at home every day, and an additional 4 respondents (33%) reported that they try to save energy at home 1-2 times a week. Only 1 respondent reported that they try to conserve energy at home 1-2 times a month, and only 1 respondent reported that they never try to conserve energy at home.

When asked about building-wide efforts to conserve energy and resources, only one individual responded that the building actively tries to encourage conservation of resources, and this individual reported that this is primarily done through informational methods (e.g. posting notices in lobby, sharing information on the Google portal). All other residents responded either that the building does not actively try to encourage conservation of resources, or that they didn’t know.

When asked if there was a “culture of conservation” in their building, answers were mixed. No respondents strongly agreed. Thirty-six percent of respondents (4 individuals) agreed, and another 36% felt neutral (neither agreed nor disagreed). The remaining three respondents either disagreed (2 individuals) or strongly disagreed (1 individual). Nearly all respondents (9 individuals, or 82%) reported that they "care a little" about what others in the building thought about their recycling or consumption habits at home.

Interviews painted a clearer picture of initiatives in the building regarding energy and resource conservation. Interviewee B recounted a number of capital improvement projects undertaken in the building during his tenure as board treasurer that have had an impact on energy costs and consumption. The building replaced the boiler in 2000 and decided to switch to oil (from gas). "This sounds a little bizarre," he explained, "but at the time it was a good decision. We've subsequently converted to duel fuel, and we've been running it on gas. The price of gas has dropped tremendously. The ability to switch fuels has been huge." He also explained that the building maintained a separate hot water heater, "but because of the boiler that was running anyway, we got almost free hot water in the winter." In summer months, the building relies on the separate hot water heater. Windows in the building have been mostly all replaced, and are highly insulated. Individual residents must opt to replace windows in their unit, but the building pays for one-third of the cost. Interviewee B also explained that the building recently installed a more sophisticated "heat computer" to replace the older heat timers that only measured the outdoor temperature if it was below 55 degrees F, which created steadily high indoor temperatures near 80 degrees with no more sophisticated way of controlling the heat system. Most residents complained often of being too hot. Interviewee A said, "We couldn't control the heat. All we could do was turn the radiators off. Now we have staggered sensors at opposite ends of the building." This change has had "monumental impacts" on both comfort and cost, according to Interviewee B, bringing the average indoor temperature down to around 70 degrees, and has reduced heating costs by approximately a third. "Our system is so old. People have been so much happier," explained Interviewee A.

When asked what the primary motivation behind these and other initiatives was, Interviewee B said, "The motivation was not environmental. It was to reduce costs and increase comfort. Some people may look at it from an environmental perspective. But that wasn't my goal." Regarding common area electricity consumption over the years of his time as treasurer, Interviewee B explained, "Well, there hasn't really been any material change except the price has gone up. I haven't really seen any change in usage. At some point we replaced the light fixtures, and we tried to use more energy efficient lighting." Interviewee A felt slightly differently. She explained, "We've been taking small steps to make the building more energy efficient. I'd rank us like a 6 or a 7 on how important it is to conserve in the building. The building composts. We use it to fertilize the garden. Everyone puts their stuff in it. We buy green (cleaning products)."

When asked if he had opinions about findings that cooperative buildings seem to consume less energy in New York City, Interviewee B said, "Hmm. If that's true, it's that co-op people expect that they will pay for things. They recognize that they are paying for things. When people aren't paying for something they use more of it. Perhaps people in co-ops are more cost conscious. But, a properly run rental building will have a cost conscious landlord too. But I guess a co-op board would be more sensitive to things. You can have an increase in the maintenance charge when the heat is going up 10% or 15%. A few years ago we had a fuel assessment. It got everybody's attention. It made everyone ask what are we doing about it."

DISCUSSION

A number of interesting findings can be discussed regarding the survey and interview data reported above. Two come to light as particularly relevant.

First, I posited in Chapter 3 that cooperative buildings are expected to be more decentralized and less hierarchical than rental properties. Findings in this building support this hypothesis. In this building, the organizational structure is nearly flat, with little to no hierarchy, in part because of the building's small size. This leads to a very high level of decentralization. It is likely that all cooperative buildings are decentralized to some extent, given that board membership is comprised entirely of residents, but some larger cooperatives will have more hierarchical and centralized board structures with a number of residents who do not participate. In this case study building, however, with only 24 adult co-op owner residents and 13 owner-occupied units with a 5-person board (with voting on membership occurring annually), everyone in the building at any given time is likely to either be on the board, married to or living with someone on the board, or friends with someone on the board. This creates an interesting and important level of resident involvement that is likely not replicable in all cooperative buildings, but unique to one of this size.

I argue that this high level of decentralization coupled with the small building size leads in turn to three unique characteristics: proximity, transparency, and a higher level of perceived control. Survey results support this argument. These three characteristics overlap and are closely related to one another. Proximity in this context refers to how close non-decision-makers are to decision-makers, and is a direct outgrowth of the decentralization mentioned above. Transparency refers here to the visibility of the decision-making process to those outside of that process. Perceived control refers to an individual's perception of the ability they have to take action or bring about change on issues that matter to them (Ajzen, 2005; Fishbein & Ajzen, 2009). It is unlikely, given survey responses regarding how well individuals know the board members, how many friendships and casual acquaintances residents have, and how many individuals have served on the board themselves, that any individual in the building could have absolutely no knowledge of who is on the board, the decisions they make, or how they can become more involved. To most residents, the board structure is both transparent and closely linked to their daily lives, and they feel they have the ability to impact decisions. I argue that, taken together, this is important because it means residents do not view themselves as outside of or separate from the decision-making process, but as part of the structure itself. As Senge (2010) writes, "The nature of structure in human systems is subtle because we are part of the structure. This means that we often have the power to alter the structures within which we are operating. However, more often than not, we do not perceive that power. In fact, we usually do not see the structures at play much at all. Rather, *we just find ourselves feeling compelled to act in certain ways"* (p. 56). Cooperatives, and this building in particular, by nature of their management type and resident board involvement, render *more visible* the structures of the system. Thus, those involved in co-op management and those that live in co-ops tend to *better perceive the power to make change*.

Secondly, there is evidence that the building has made a number of decisions regarding capital improvements that allow it operate in an energy efficient manner.

Although building-wide energy data is not available to compare the building to others, the variety of initiatives implemented over the years, including the heat sensors, duel-fuel system, and highly insulated windows, indicate a willingness to make investments for efficient building operations. This leads to three sub-points regarding energy efficiency. First, these initiatives were not environmentally motivated, but instead were implemented out of a desire to be cost efficient. Second, despite a high level of investment to operate the building efficiently, survey findings indicate that the residents themselves do not believe the building actively tries to encourage energy or resource conservation. Third, leadership in the building, particularly that of Interviewee B, has influenced both of the above points. Each of these will be discussed in turn.

First, as reported by Interviewee B, the implementation of many energy efficiency initiatives over the years was not motivated by a concern for energy conservation, but by a concern for cost savings. From an economic and organizational perspective, this makes sense. Implementing capital improvements to save money over the long term in a cooperative is an efficient and rational decision given shared ownership. It highlights the lack of principal-agent issues in cooperatives. In addition, it points to the benefits of this type of ownership structure in reducing transaction costs for homeowners; since they are members of a collective, they do not have to access and analyze information, weigh competing alternatives, and make investment decisions for expensive capital improvements as a single owner of a single-family structure. Additionally, New York City is a special case given the ubiquitous presence of the cooperative building as a housing type. Since the city has many decades of experience in the legal structures of co-op ownership, cooperatives have an even deeper transaction cost advantage over other forms of homeownership, like condominiums (Hansmann, 1991). Thus, although it would make for a compelling story if the building was motivated by environmental concern alone, for these reasons it makes sense that the decisions to implement energy efficient capital improvements were borne out of an efficient and economically rational self-interest.

Second, despite a significant building-wide investment over the years in improvements that increase the energy efficiency of the building, residents themselves interestingly do not report that the building actively tries to conserve energy or resources. Most residents say the building does not promote a culture of conservation or that they are unaware of any initiatives to save energy or resources. This is in keeping with the above – if the primary motivation for implementing these improvements was cost efficiency and not energy efficiency, it follows that building residents would not think of or necessarily perceive the building as energy efficient. It illustrates that although the organizational characteristics discussed as important above – transparency, proximity, and perceived control – may lend themselves to an organizational advantage in implementing initiatives, they are not determinants of a pro-environmental inclination, per se. As explained above, it simply helps make visible the system of decision-making. It is easier to implement a switch to duel fuel system when the board members are all aware of resident complaints about heat. Residents are supportive of such a capital improvement when their wife/friend/neighbor on the board can commiserate about the high temperatures and tell them how much money they will save. Residents need not view energy efficiency as a priority in order to be supportive of these improvements.

Finally, despite the significant role of decentralization in ensuring power is dispersed and more equally distributed in a building system, organizational literature still points to the importance of leadership in driving organizational outcomes (Schelly et al., 2011; Senge, 2010; Teixeira & Werther, 2013). In the case of this particular building, that leadership is evident in the role of Interviewee B, a long-standing member of both the building and the board who brings with him knowledge of the evolving history of the property, along with appreciation for younger involved newcomers like Interviewee A. This building has the particular advantage of having the longest-standing board member also serving in the role of treasurer. This individual is able to then understand and analyze financial information in an informed manner *and* with a historical perspective others may not have, so that the building can make smart decisions about evolving cost concerns and potential capital improvements over the long-term. This, too, has been instrumental in this building's success. This leadership has also contributed, in large part, to both of the first two points, above. Interviewee B's position of leadership has allowed him to craft a strong and compelling *narrative* of cost savings and operational efficiency over the decades. It is this narrative that informs both the perceived impetus behind the implementation of energy efficient capital improvements as well as the perceived lack of a conservation culture or active conservation efforts among residents in the building.

The above two points and their related sub-points lead to a few policy recommendations. First, this research highlights the need to leverage the existing leadership structures in order to shift the organizational narrative to one that blends energy efficiency for cost as well as environmental reasons. What would the trickle-down effect of this narrative be on building residents and perhaps in individual households? This remains to be seen, but opens up an area for future research.

Second, in instances where some of the organizational factors are already in place – such as a cooperative building with a high-level of decentralization -- policies should be considered that strengthen those existing characteristics and allow for the growth of additional beneficial characteristics. For instance, Low et al. (2012) suggest policies that would force cooperative boards to disclose their reasons for rejecting applicants as a way of making them more inclusive. Similarly, in buildings with very tightly controlled boards that exhibit a high level of centralization and solicit little input from other residents, perhaps term limits on board membership would be effective, or requiring a mandatory year of service from all residents.

CONCLUSION

This chapter discussed two important findings about a small, older cooperative building in Prospect Heights, Brooklyn. First, there is very little hierarchy and a high level of decentralization, in part because of the building's small size. This leads to high levels of transparency, proximity, and perceived control. Secondly, the building has implemented a number of energy efficiency measures. However, these measures were not necessarily implemented out of environmental concern, and most residents do not report a "conservation culture" in their building. These two outcomes are partially attributable to the leadership of one long-standing individual who serves as board treasurer and has shaped the narrative for action in the building over prior decades.

Low (2001; 2012; Low et al., 2012) provides one of the most comprehensive bodies of qualitative and ethnographic work on cooperative buildings in New York City, but no work, to my knowledge, has attempted to meld this understanding of the social and cultural aspects of cooperative buildings with evidence regarding energy consumption, opening up a vast potential for future work. The work in this and prior chapters only begins to touch upon this theme, but more research is needed.

One avenue would be to replicate a study such as the one presented in this chapter in a cooperative building that is larger. This would provide the opportunity to better understand and distinguish between those social factors presented here that have occurred because of the cooperative's organizational structure itself or because of the building's small size. It would also allow for a larger sample size, which is admittedly small in this research.

Similarly, it would be useful to replicate this study in a building where full-building energy data is available. Although there is value to the qualitative data presented here, and the in-depth look at the perceptions of residents, it would be helpful to link this subjective and self-reported data to actual observed energy use.

Finally, it would be interesting to further study a cooperative building that was designed as a green building or has been retrofitted to now operate as a green building. The organizational narrative is likely to be very different in a green building, as the motivation behind energy efficiency will surely include at least a moderate amount of environmental concern, and it would be helpful to observe how this shifted narrative has impacted outcomes.

CHAPTER 6
RENTAL BUILDINGS AND THE ROLE OF CENTRALIZATION AND SOCIOECONOMIC STATUS

INTRODUCTION

Up to this point, this research has focused most of its attention on the whole building as the unit of analysis. Although the building still remains the primary focus, this chapter takes a finer grained look at the household level in two of the study buildings. Households consistently impact building performance, so it is important to address their role. Chapter 3 highlighted interesting new hypotheses regarding the possible importance of centralization in rental buildings, but Chapter 4 still found that rental buildings consume more energy than cooperatives. This section takes a deeper look at the complex relationships between organizational actors – namely, tenants and building managers – in rental properties. As explained previously, in rental building organizations, occupants tend to play the role of customer of the organization, not member or decision-maker of the organization. In addition, the rental market has the additional complication of the split incentive issue, known as principal-agent (or landlord-tenant) misalignment (Kleindorfer et al., 1993; Panayotou & Zinnes, 1994) This issue is particularly problematic in the residential rental market because the party responsible for adopting an energy efficiency measure is typically not the same party that will reap the financial benefit from the increase in efficiency. Additionally, renters typically have limited allowance to make significant renovations or rehabilitations to leased property and less long-term investment than owners.

If renters view themselves as customers, requiring services and amenities, and if there is little to no incentive to care about the building's efficiency overall, they are likely to have a more individualistic attitude towards conservation measures. As explained in previous chapters, rental occupants consistently used words like "they" and "them" instead of "we" and "us" when referring to their building in interviews, and many occupants reported they cared very little or not at all about what their neighbors think of how much they consume or conserve energy at home. How, then, will this play out in an high-income versus low-income rental building, especially if both buildings already have the added advantage of being built green or energy efficient?

This chapter adds to the previous chapters' work on buildings-as-organizations by taking a closer look at the flip side of the decentralization coin, and by balancing the detailed work on cooperative buildings with an exploration of the rental market. This chapter explores these issues by taking a closer look at Building 2 and Building 4, both green/energy efficient rental properties. Building 2 is a luxury building, and Building 4 is a low-income building. This chapter explores two hypotheses. First, that centralization is likely a helpful organizational characteristic in buildings where residents play the role of organizational customers. This hypothesis builds upon the findings in Chapter 3, where I proposed a low score for buildings with a high level of centralization, arguing that decentralized operations that disperse power and decision-making among residents are more likely to result in energy efficiency engagement. However, the findings in that chapter highlighted a number of rental properties that performed better than expected. These buildings were both centralized and had residents as customers, leading to the hypothesis that when the resident plays the role of a customer, as in most rental buildings (luxury and not), perhaps some level of hierarchy, centralization and control is helpful and *even necessary* in order to implement and (more importantly) enforce energy efficiency measures within the building. Thus, a new hypothesis emerged that posited that rental buildings require some level of centralization and organizational control and capacity in order to successfully implement energy efficiency measures. Second, this section hypothesizes that within rental properties, individual determinants – in particular household income and socioeconomic status – can "override" efficient building features. As such, this section explores the specific role of a green or energy efficient property when coupled with high- or low-income occupants. How effective is a high-performing building if occupants have high incomes and little incentive to save (money or electricity)? As we saw in Chapter 3, luxury buildings are likely to consume more energy due to a high level of amenities and service, and this section explores if this is true at the household level as well. Additionally, this work helps shed light on the role of income elasticity as it relates to individual households. The concept of income elasticity of demand is well established in economics, and aggregate data provide solid evidence in support of the concept, but the elements of this emergent behavior are less well understood at the micro level of the household. Finally, this section also explores the organizational role of the management company members in both of these instances to better understand how strong leadership and organizational capacity can drive outcomes in each of these situations.

This section is organized as follows. First, it reviews background and existing research on renters, socioeconomic status, and relevant issues regarding energy efficiency. It also offers some background on the New York City rental market. Next, it outlines the methodology utilized in collecting data in the two buildings, along with the procedure used in analyzing the data. Evidence is provided from surveys, interviews, and monthly kilowatt-hour (kWh) billing data from the two rental buildings. Next, it outlines results of data collection and analysis. Finally, it offers a discussion of the implication of the findings and policy recommendations.

The New York City Rental Market

Urban renters make location decisions based on bundles of attributes offered by different properties, including neighborhood, distance from place of employment, schools, amenities offered in the building, sustainability features and, in particular, cost and affordability. Monthly rents in New York City apartments vary widely, as do the range of amenities offered. Average 1BR rents in Manhattan in September 2014 were $3,399 USD per month; in Brooklyn they were $2,624 USD (Miller Samuel Real Estate Appraisers, 2014). The average monthly rental price for an apartment in the top 10% luxury tier in Manhattan in September 2014 was $8,850 (Miller Samuel Real Estate Appraisers, 2014). On the affordable side, average rents in New York City Housing Authority (NYCHA) properties were $445 as of April 2014 (New York City Housing Authority, 2013). In the study buildings for this research, similar variability is evident. Building 2, the luxury high rise, offers 1BR apartments for $4,000 to $6,000 per month. Building 4, the low income building, provides apartments only to individuals earning less than 60% of the City's area median income (AMI) (Enterprise Green Communities, 2009). As a result, average rents for 1BR apartments are under $1,000 per month (Enterprise Green Communities, 2009).

While energy efficiency may be one component of a resident's location decision, it is rarely the deciding factor, especially when weighed against the cost of rent. Further, energy efficient and conventional (non-green) rental properties in New York City can be found at all ends of the rental price spectrum. For instance, many of New York City's most expensive rental properties are amenity rich, but not designated as green or LEED-certified buildings. This indicates that those willing and able to pay a very high monthly rent do not necessarily seek out energy efficient properties in their location decision. Conversely, a number of affordable housing developers are constructing new properties with energy efficient and green features, even though the rents will be below market value.

Understanding Occupant Consumption Behavior

Getting to the bottom of the consumption decisions of residential occupants is a difficult undertaking, especially in rental properties. Much of the electricity usage in a given apartment is "built in" to a residence, and urban rental buildings vary in the extent to which they are designed for occupant control of energy consumption. Even if they are directly metered (meaning each resident receives an individual electricity bill each month), many buildings only allow for resident control of plug-load, giving urban renters poor control over electricity usage. The United States Energy Information Administration (EIA) offers supporting evidence. The 2009 Residential Energy Consumption Survey (RECS) data show that appliances, electronics, and lighting – in many cases the only controllable elements of an occupant's apartment – make up only 26% of the average resident's total energy consumption in New York State, compared to 35% nationally (Energy Information Administration, 2013). This leaves a good portion of additional consumption out of the control of the occupant, giving more weight to the organizational strength and capacity of the management organization. Finally, residents are heterogeneous, and have widely differing preferences, thresholds, and motivations, and respond differently to different incentives(Andrews, 2000)Andrews & DeVault, 2009). There is no "one-size-fits-all" solution for building organizations to induce behavior change or reduce resident consumption; thus, targeting the efficiency of base building systems and operations is often the easiest target for owner organizations, especially if implementing rules or restrictions might jeopardize resident retention.

Why Income is Important

Income and response to pricing are two such areas of heterogeneity among building occupants, and the role of income in consumption choices – and, in particular, elasticity of demand and rebound effects – have been widely studied. Elasticity refers to the sensitivity in consumer demand of a particular good in response to changes in price or income (Mankiw, 2004). If demand for the good in question is inelastic, it is likely that demand will change very little even if the price of the good increases, or personal income decreases. The demand for gasoline is highly inelastic because drivers depend on daily automotive transport, especially in the short run. By contrast, the demand for Coca Cola is highly elastic because there are many reasonably priced and widely available substitutes. Residential electricity demand is relatively price inelastic and income elastic (Bernstein & Griffin, 2006). Relatedly, the rebound effect "Refers to a behavioral or other systemic response to a measure taken to reduce environmental impacts that offsets the effect of the measure" (Hertwich, p. 86, 2008). For example, leaving efficient bulbs on for longer times than less efficient ones that these replaced, or leaving on computers and other appliances in the knowledge that they use less energy than predecessor models, are actions that could offset part of any efficiency gains. Greening et al. reviewed nearly 75 empirical studies of individual, firm and economy-wide rebound behaviors as they relate to various resources (Greening, Greene, & Difiglio, 2000). On the individual consumer side, they explored space heating, space cooling, water heating, lighting, appliances, and transport (totaling nearly 70 studies in all). The potential size of the rebound effects they examined ranged from zero to 50 percent, with most settling in the range of 10% to 30% (Greening et al., 2000). A rebound effect may also go in a positive direction, inducing more of the desired behavior, but this dynamic is not well understood (Hertwich, 2008).

Importantly, energy bills are a larger fraction of monthly income for low-income residents than for high-income residents. As a result, some household energy consumption is income-elastic and highly determined by income and affordability, not lifestyle or conservation goals. Most researchers find electricity to be income-elastic, indicating income has a strong influence on demand (Cayla et al., 2011; Jamil & Ahmad, 2011; Wilson et al., 2013). One study found household income to be the most important determinant of electricity demand at home (Filippini & Pachauri, 2004). This can work to the advantage of energy efficiency in low-income households, as researchers have found that households with income constraints consume much less electricity on average than middle- or high-income households (Cayla et al., 2011). Low-income households may be less likely to make upfront investments in energy efficient appliances (Murray & Mills, 2011). However, if income increases – either through personal employment changes or through increased efficiency in products or building technology that cause the price of consumption to drop – there is evidence that rebound (or take-back) effects will be stronger in these households, as they use the gains in efficiency and resulting cost savings to engage in behavior that allows them to catch up to a more middle-class consumption lifestyle (Cayla et al., 2011; Hertwich, 2008; Jamil & Ahmad, 2011). One study found that household GHG emissions (a direct result of electricity and other home and transportation consumption choices) remained relatively stable until income reached $79,999 (Canadian dollars), at which point household emissions jumped significantly;

emissions then leveled off again after this jump (Wilson et al., 2013). Again, this is attributed to the fact that income initially supports a basic level of consumption, which remains relatively stable at low incomes until a certain threshold is reached, at which point the household can invest in a more consumptive lifestyle.

METHOD

This research utilizes a mixed methods approach of both quantitative and qualitative data collection to achieve a triangulation of information to characterize household energy use and the role of management. Data were obtained from researcher- and self-administered surveys, interviews, and monthly kWh consumption data in each building provided by building management and the local utility. This section of the paper will outline in more detail the study sites, study design, participants, and analytical approach to this research.

Site

This research was conducted in two urban multi-family residential rental buildings located in New York City approximately 10 miles apart. Both buildings were study sites for a large National Science Foundation project conducted by the Rutgers Center for Green Building (RCGB), of which I was a part.

Building 2 is a luxury green residential high-rise building that has achieved a Leadership in Energy and Environmental Design (LEED) certification from the United States Green Building Council (USGBC). The building has 293 apartments, ranging in size from studios to three bedrooms, and has been occupied for 11 years. Approximately 700 people are residents of the building. In order to earn its LEED Platinum rating the building had to meet minimum energy efficiency requirements by benchmarking energy use to demonstrate that the building performs at or better than the 69th percentile of similar buildings using national source energy data available in the Environmental Protection Agency's Portfolio Manager tool(United States Green Building Council, 2014). It also had to meet certain criteria for water conservation, energy efficiency, materials and finishes, and indoor air quality. The building is approximately 30 stories with gross square footage of 350,000 SF and provides a centralized ventilation system for cooling and heating. It also includes on-site photovoltaic panels, provides 100% fresh outside air and individual thermal comfort control, avoids certain building materials that are sources of indoor air contaminants, and offers enhanced maintenance.

Building 4 is not LEED certified, but at the time of its completion in 2009 it was the largest *EnergyStar* certified, multifamily, affordable high-rise residence in the United States. Building 4 is seven stories and occupies almost 150,000 SF with 127 one-, two-, and three-bedroom apartments and over 6,000 square feet of ground-floor commercial space. Approximately 400 people occupy the building. It was constructed to serve some of the area's most vulnerable low-income residents. A number of conservation and energy efficiency features were incorporated into Building 4's design, including low flow faucets and showerheads, Energy Star fixtures and appliances, and energy-efficient windows with transparent metal coated (low-e) double-pane glazing to reflect heat during summer and retain heat during winter. An energy efficient heating and ventilation system and insulation were incorporated in the building's construction, but the building does not have a centralized cooling system. Compact fluorescent lights and occupancy sensors for lights were installed both in common areas and inside apartments. The interior of the building was finished with recycled and low - VOC materials, paints, sealants and caulks.

Study Design

This study relies primarily on kWh data, with supporting evidence provided by qualitative interviews and surveys in each building. The management company and the local utility (with permission of the tenant) provided the research team at RCGB with monthly kWh billing data for both buildings.

Building 2 kWh data was provided for all apartments individually for the 12-month period from Oct 2010 through Sept 2011 (n=293). In-person in-depth interviews were conducted with a subset of 14 residents during the summer of 2011, and a building-wide survey was administered in early December 2011 via an email link to residents, in person on laptops in the building lobby, and via paper hard copy; choice of survey instrument was at the discretion of the resident. Of the total population of 293 apartments in Building 2, we received 161 survey responses (55%). The 14 residents with whom interviews were conducted also completed the survey at the time of the interview.
In Building 4, kWh data was provided for all apartments only as an aggregate building-wide total for the 12-month period from March 2011 through Feb 2012 (n=120), and for a subset of individual apartments from Oct 2010 through Sept 2011 (n=13). Interviews and surveys were also conducted in Building 4 in March and April 2013. Interviews were typically conducted in the respondent apartments. Because most households did not have a computer, a team of researchers administered the surveys in this building, also typically in the respondent's apartment. Fifteen residents participated in both the survey and interview process.

For both Building 2 and Building 4 NYC LL84 disclosure data was used to analyze whole building energy consumption. Since the kWh data made available to us did not include base building systems or common areas, the disclosure data provided an additional important data point.

The survey was nearly identical in both buildings and consisted of a range of questions regarding resource consumption at home, opinions about the building and apartment unit, beliefs and opinions regarding energy and environmental conservation, and explanations for why they moved into the building. Interviews also were nearly identical in both buildings; participants were asked how they felt about the building, indoor environmental conditions (temperature, air flow, humidity, dust, odors, etc.), apartment cleaning habits, behaviors that affect air quality (opening windows, changing air filters, smoking etc.), and energy use. Survey and interview findings were intended to provide confirming evidence and additional depth to kWh findings.

Since the two buildings differ in number of apartments with available kWh data and level of kWh data available (e.g. household level vs. aggregate building totals), this analysis uses two subsets for comparison. First, it uses the billing data from only the subset of apartments in Building 2 that completed a survey for the study and could be matched to kWh data from the same time period, and totaled this data, resulting in total-building aggregate data with a comparative sample size to the larger aggregate-level sample available for Building 4 (approximately n=120 in each building). This aggregate data was then normalized on a per apartment basis. Next, it utilizes the smaller subset of apartments in each building for which both individual household kWh billing data and survey and interview data was available (approximately n=15 in each building). See Table 6.1 for an explanation of data used for each building.

Table 6.1. Explanation of data used in each building

	Whole building data	Aggregate household kWh data (n)	Individual apartment kWh data, survey, and interview (n)
Building 2	kBtu/ft2 from LL84	120	14
Building 4	kBtu/ft2 from LL84	120	13

In both buildings, the overall research design was presented to residents as an independent study by an academic research center having no affiliation with the building or building management. Residents were told the goals of the study were to learn more about the building's performance, occupant satisfaction with the building and their apartments, and occupant behavior within the building. The population of residents was demographically homogeneous within each building, so no stratification was utilized.

Participants and Household Characteristics

In Building 2 there was little variation by age, education and income among survey respondents. Thirty-seven percent of respondents resided in two-person households and 28% resided in four-person households. Many families had small children: Thirty-nine percent of surveyed households reported children under 10. Gender and age were consistent: Respondents were 54% male and 45% female, and over 70% of respondents were between the ages of 30 and 49. Over 90% of respondents were college-educated with a 4-year degree or higher. Eighty percent of respondents reported an income of above $200,000/year USD. The survey did not ask respondents to report their race or ethnicity.

In Building 4, the study sample closely mirrored the study population based on demographic data provided by the building owner. The study sample was largely women/female heads of households (82.5% of participants were female, 12.5% male), African American and Latino (12.5% of participants were interviewed in Spanish, and 15% listed Spanish as their primary language), with an average age of 35 years. Of the 15 combined survey/interview participants, 88% had incomes of less than $20,000 and 19% had earned a Bachelor's degree.

Analytical Approach

This study first converted raw monthly billing data to useful form so that it could be accurately compared between the two buildings. Building 2 data was made available for individual apartments, while Building 4 data was made available only as a total for all apartments for each month, with the exception of a small subset of apartments. Thus, data needed to be normalized for both buildings in order to generate an average per apartment, per person, and per square foot annually. The resulting sample size of aggregate data is approximately n=120 for both buildings. Average electricity cost for these samples was also calculated using average kWh pricing for the local NYC area. In addition, whole-building energy use was available for both buildings in New York City's 2013 LL84 disclosure data, as reported in Chapter 3. Survey and interview data for the smaller subset of apartments in each building was analyzed and cleaned as needed. Specific survey and interview questions lend support to findings from kWh data; thus, kWh data was triangulated with survey and interview data. Results presented below are organized into two sections; first, the whole-building LL84 data is reviewed, tackling the higher-level organizational attributes that this is reflective of. Then, the individual subset of household data is reviewed along with interview and survey findings. This household data is split into aggregate results and individual apartment results.

RESULTS

Results of the analysis indicate two main findings. First, as a side-by-side whole-building snapshot, Building 2 consumes more energy than Building 4, with a source EUI in 2013 of 202 kBtu/ft^2 vs. 120 kBtu/ft^2. Second, findings from individual apartments (along with supporting evidence from interviews and surveys) indicate a similar pattern, showing substantially higher levels of household consumption in Building 2 than in Building 4. Each of these findings will be discussed in turn.

Whole Building Organizational Analysis

Source EUI for Building 2 as reported in the 2013 LL84 disclosure data was 202 kBtu/ft^{2,} and for Building 4 was 120 kBtu/ft^2. As reported in the revised scoring in Chapter 3, Building 4 also scored higher on the organizational criteria developed in that section than Building 2, receiving a 12 versus a 9. A major difference in the organizational scores of the two buildings was in building status. See Table 6.2 for a snapshot.

Researchers (Ashkenas et al., 1995; George, 2012; Mintzberg, 1992; Scott, 1991, 2013) have found that centralization is generally indicative of a more tightly controlled organization with a concentrated center of power. These organizations usually have a clearly-defined hierarchy with a top-down structure, and a clear division of roles and responsibilities. While these attributes might be harmful to the formation of innovative new programs to conserve energy and resources, rental properties are a special case because of the unique role of the resident as a customer. Whereas cooperative residents are likely to make suggestions to the building's board about initiatives (energy efficiency or other), in which case a highly centralized structure would be detrimental to the ability of residents to see, understand, and participate in the structure of decision-making, in rental buildings residents are *unlikely to want participate to begin with.* Thus, the support of a decentralized structure in promoting and fostering participatory decision-making is a moot point; therein sits the key distinction between rental buildings and cooperatives. As such, the role of leadership, which was still highly relevant in the prior chapter's work in the small decentralized Brooklyn cooperative, becomes even more important in rental buildings with residents-as-customers. In order for there to be strong leadership in the building, the building organization must be centralized to some extent, and the organizational boundary must be fairly contained (that is, the person in power in the centralized scenario should be unique to that one building, even if the owner organization owns multiple properties). Thus, centralization in rental properties becomes not a hindrance, but a help.

Table 6.2. Building 2 and Building 4 Organizational Comparisons

Baseline Evaluation				
Building Characteristic	**Building 2**		**Building 4**	
Organizational Type	Rental	1	Rental	1
Organizational Size	Large	1	Medium	2
Member Role	Customer	1	Customer	1
Total Baseline Score & Outcome	**Recommendation?**			
3 to 6: Centralization recommended ↕ 7 to 9: Decentralization recommended	Centralization	3	Centralization	4
Tier One Score	**Building 2**		**Building 4**	
Organization meets centralization/decentralization recommendations?	Yes	3	Mostly	2
Tier Two Score				
Organizational Goal	Economic	1	Balanced	2
Organizational Boundary	Moderate	2	Contained	3
Resident tenure	Medium-term	2	Long-term	3
Building status	Luxury	1	Moderate	2
TOTAL SCORE	**9**		**12**	
Actual 2013 Source EUI	**202.2**		**120**	

Both Building 2 and Building 4 are centralized. In Building 2, many residents in both surveys and interviews remarked about how well organized, highly controlled, and highly responsive the management team was, citing often by name the key individual at the helm of the operations. This individual (the building manager) holds a highly ranking position in the owner organization and has complete responsibility for the day-to-day operations of the building and management of all on-site staff. In addition, he lives on the property with his wife and children. For these reasons, he has eyes and ears throughout the premises and is never truly "disconnected" from the happenings of the building. He was pointed to again and again as the main reason why things ran so smoothly at Building 2. He has also been a pioneer for the energy efficiency initiatives in the building, tweaking water and energy use in public areas in response to data and information after the first few years of operation, training residents as needed, and ensuring staff follow the building's green protocols. It is important to note, however, that he was always incredibly careful to not cross lines with our research that may inconvenience residents in any way. Resident comfort and sense of security with our work in the building was always his top priority. Thus, he did not advocate for energy efficiency at the expense of his high-paying customers. This is a key point in support of the argument that residents act as customers in most rental buildings, and that management will only push so far when comfort or convenience is at stake.

Building 4 is also a centralized organization, operated by an affordable housing entity called the Women's Housing and Economic Development Corporation (WHEDCO). The role of WHEDCO goes beyond that of a traditional management company in a for-profit rental building, whose main goal is ensure the building is operational and residents are happy. In this vulnerable population, WHEDCO also worked to develop healthy eating and living programming for residents, host on-site activities, and encourage use of facilities like the shared garden. Although use of these programs and services was low in the building, their existence points to a top-down influence and hierarchical operation. It should be noted, however, that Building 4 is not as centralized as Building 2. This is likely due to lack of additional organizational capacity at Building 4 due to budgetary constraints, while Building 2 has an abundance of highly trained, highly paid staff as a result of the extremely high rents being charged. Building 4 contracts with an outside entity to provide front desk service, for instance, and there is accordingly a high amount of staff turnover.

The main distinction in the two buildings in their organizational criteria scoring was in building status. Building 2 is a high-end luxury building with an abundance of both services and amenities. The property has a 24-hour doorman presence (in a well-lit, large, and comfortable lobby, with separate areas for residents' package storage, dry cleaning drop-off, Fresh Direct deliveries, etc., and three elevators), a small gym, a play room, and a rooftop garden. In addition, residents have in-apartment washer and dryer units, high end dishwashers and an abundance of other amenities like wine coolers. Building 4 is a low-income affordable residence housing formerly homeless individuals with a moderate amount of basic on-site amenities and services. The lobby is moderately sized and not designed for long "lounging." The residents do not have in-apartment washers and dryers, but a shared facility in the building. Apartments have mid-range energy efficient appliances built into the apartment and some basics of their own (but only some households have computers, and most do not have high-end appliances like wine coolers). This distinction has a large bearing on the annual EUI results from each building.

Given the similarity in organizational scoring, it is somewhat surprising that the EUI for Building 2 is not just marginally higher than Building 4, but significantly higher. This suggests that beyond there are also major household differences attributable in part to the level of amenities and service captured in the building status score. This will be discussed below.

Household-Level Findings

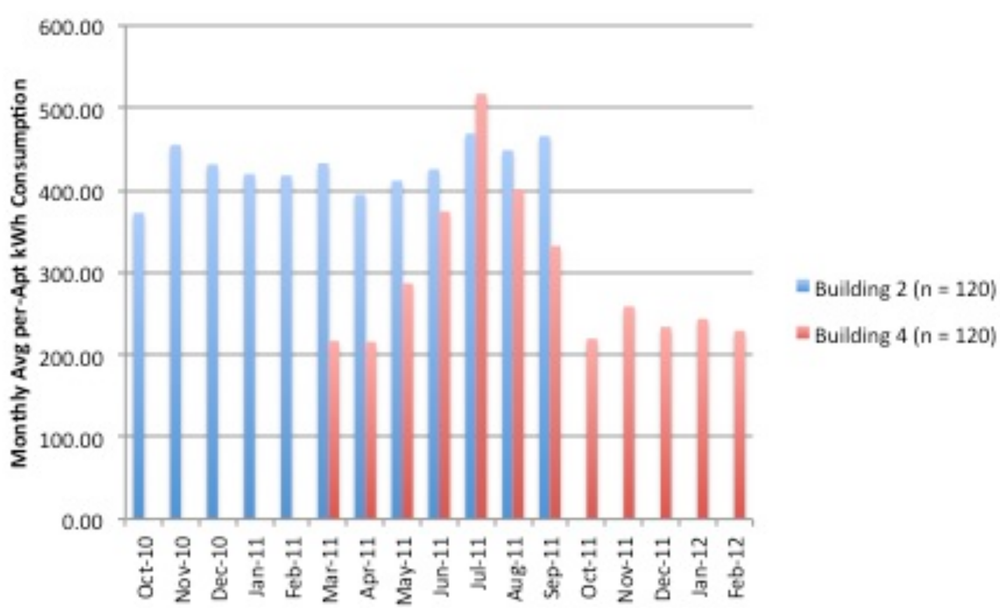
Findings indicate that low-income individuals, who are unable to afford as many building amenities, are also more likely to respond to price signals due to the heavy burden the electricity bill places on their monthly budget. Conversely, wealthier individuals who tend to locate in amenity-rich apartments with technologies and feature that consume more energy, generally ignore weak price signals. The electricity bill places little burden on their monthly budget, allowing preferences for comfort and convenience to drive consumption decisions. Energy efficient appliances and other green building amenities in the homes of high-income residents are unlikely to offset their significant consumption. This seems to be the case regardless of the high level of control at the organizational level.

Aggregate kWh Results

Findings from aggregate metered household kWh data from the study buildings indicate that for approximately the same number of apartments, monthly average metered household electricity consumption in Building 2 – the LEED Platinum property – is substantially more than that of Building 4. Note that this excludes electricity consumed by central systems and common areas, which is accounted for in the EUI figures.

Normalized on a per apartment basis, residents in Building 2 consume on average 428 kWh per month; residents in Building 4 consume on average 303 kWh per month (See Figure 6.1). Normalized on a per person basis, average annual consumption is approximately 1,888 kWh per person per year in Building 2 and approximately 1,093 kWh per person per year in Building 4. In Building 4, which does not have a centralized cooling system, residents must rely on window air conditioners during summer months. This is evident in the June 2011 – August 2011 months, the only instances where monthly consumption meets or exceeds that of Building 2. Building 2, which does not rely on window air conditioners and does not charge residents more each month based on their individual use of heat or air conditioning, shows consistent and steady kWh consumption over the entire 12-month period. In all except summer months, this consumption greatly exceeds that of Building 4. If air-conditioning is subtracted from household utility bills in Building 4 to make the metered end uses more comparable, then households in Building 2 consistently use more electricity than those in Building 4.

Figure 6.1 Average monthly kWh consumption in Building 2 and Building 4



Whole building electricity consumption (including common areas and central systems, as well as individual apartments) normalized per square foot is approximately 10.2 kWh/SF per year in Building 2 and 5.7 kWh/SF per year in Building 4. See Table 6.3 for a summary of these figures.

Table 6.3. Summary of Building 2 and Building 4 aggregate energy and electricity findings

	2013 EUI (kBtu/ft2)	Average kWh per apartment/per month	Average kWh per person/per year	Average kWh per SF/per year*
Building 2	202	428 kWh	1,888 kWh	10.2 kWh
Building 4	120	303 kWh	1,093 kWh	5.7 kWh

Individual Household kWh Findings

Fourteen households were interviewed in Building 2; these residents also completed the survey at the time of their interview, and monthly kWh data was made available to us for those apartments. Of the 14 households, only one household did not report income. In Building 4, 15 occupants were interviewed and surveyed. Of the 15, individual household kWh data was made available for 13 apartments. This section reviews the data from this smaller subset of apartments in each building. This data provides a more contextual understanding of the consumption patterns in each building.

Results from individual household monthly billing data for these apartments indicate that residents of Building 2 still consume more on average than Building 4 residents, but with a slightly narrower gap. Average monthly consumption in the 14 households in Building 2 for the time period Oct 2010 through Sept 2011 was 377 kWh/month and 287 kWh/month for the 13 households in Building 4. This average is slightly lower than the building wide average for both buildings.

Survey respondents in both buildings were asked to report household income (See Figure 6.2). The survey also asked respondents how important it was to avoid extra cost and expense (scored on an ordinal 1-5 scale: Not at all important, Slightly important, Neutral, Very Important, Supreme Importance) (See Figure 6.3). When kWh data is paired with these two survey questions the data begins to paint a picture of more contextual decision making factors in each building. It would be expected that income would scale with kWh consumption. It would also be expected that income would have an inverse relationship with the respondent's expressed level of importance of avoiding extra expense (e.g. a lower income would rank higher on importance of avoiding extra cost). See Figure 6.4. Findings indicate that in Building 4 these expected outcomes occurred. All but one of the 13 occupants reported that it was very important or of supreme importance to avoid extra cost and expense. Consumption remained relatively stable among these occupants, and lower than occupants of Building 2. In Building 2, findings were less straightforward; instead of moving in the opposite direction of Building 4, they illustrated a large amount of variability. Those with the highest incomes did not necessarily express the least concern for avoiding extra cost and expense; nor did those highest income residents consume the most electricity. Some respondents in the lower income categories for Building 2 consumed more electricity and reported a lower concern for saving money. This variability in both monthly consumption and reported importance of avoiding expense points to a lower level of concern for price signals; residents can make consumption decisions based on other factors, such as comfort, convenience or simple routine.

Figure 6.2. Distribution of annual HH income in both buildings.

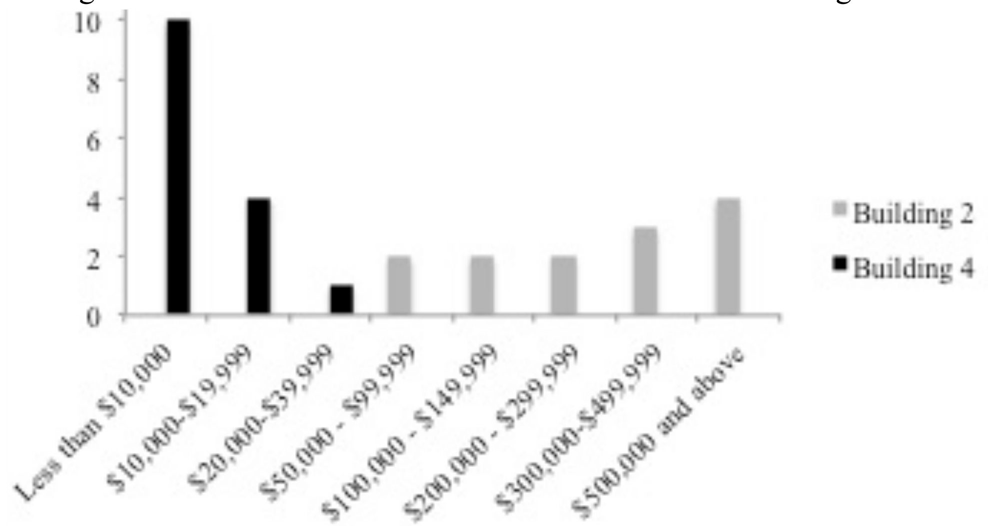


Figure 6.3. Importance of avoiding extra cost and expense.

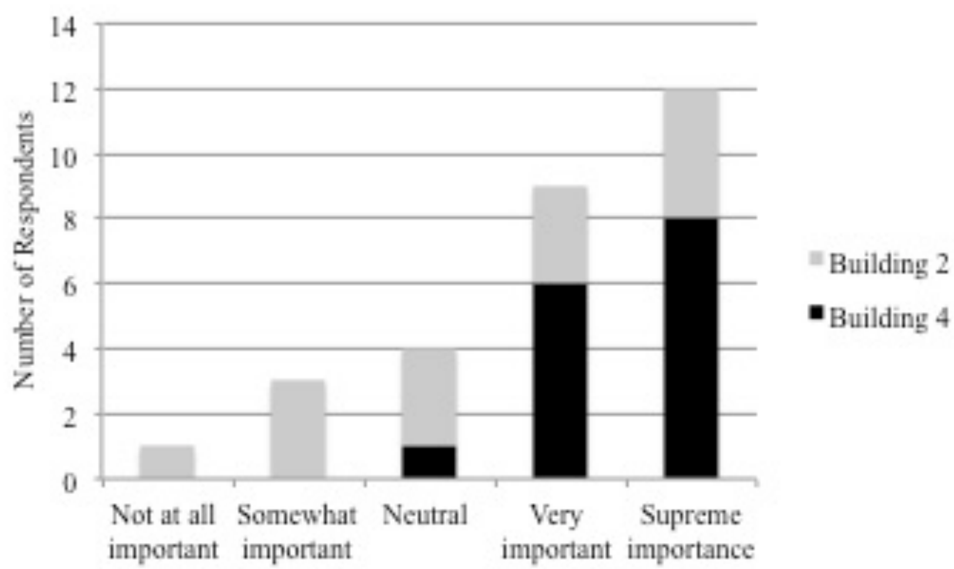
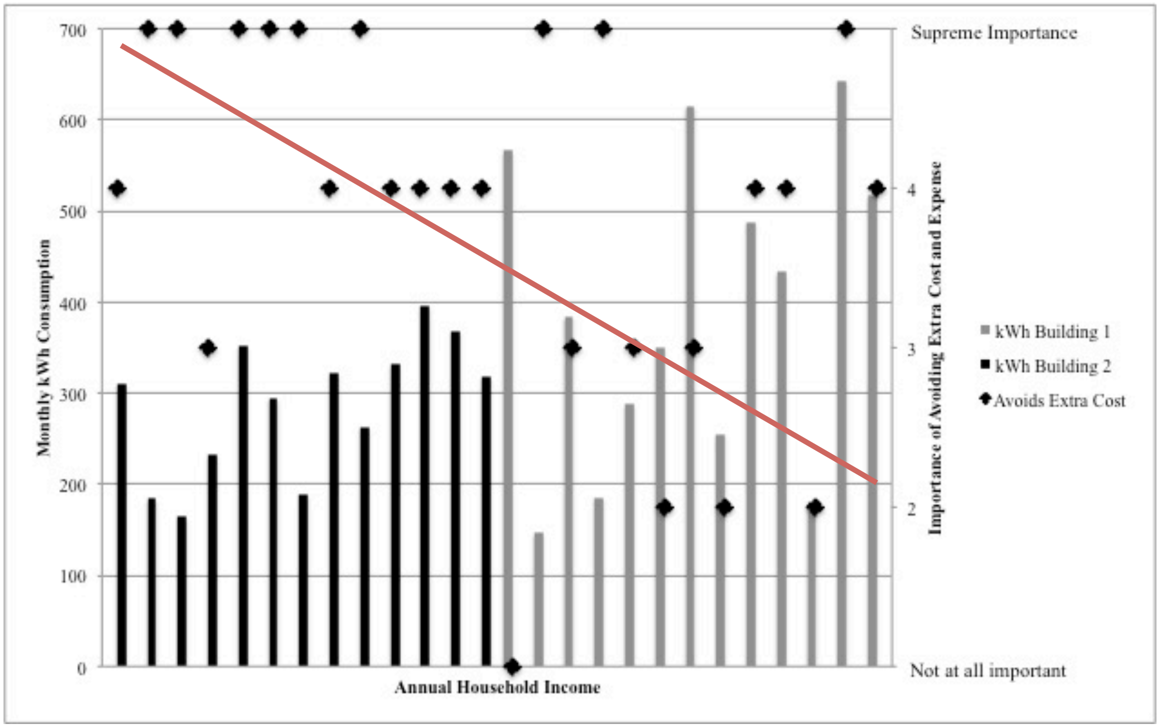


Figure 6.4. Relationship between household income, kWh consumption, and importance of avoiding extra cost and expense (n=13 in each building)



Residents of Building 2 and Building 4 face very different burdens on income from their monthly and annual electricity costs (See Figures 6.5 and 6.6). Approximate annual electricity costs were calculated for each of the 13 apartments in Building 2 and 13 apartments in Building 4 using average kWh pricing data for the New York City region (approximately $0.208/kWh)(U.S. Bureau of Labor Statistics, 2014). Findings indicate that all 13 residents of Building 2 pay less than 2% of their annual income for electricity. Seventy-seven percent of the Building 2 sample residents pay less than one-half of one-percent of annual income for electricity. In Building 4, none of the 13 residents pay less than 2% of their annual income for electricity. Fifty-four percent of that sample pay between 5% and 7.9% of annual income for electricity; 33% pay between 8-10% of annual income for electricity.

Figure 6.5. Annual electricity cost share of HH income, Building 2.

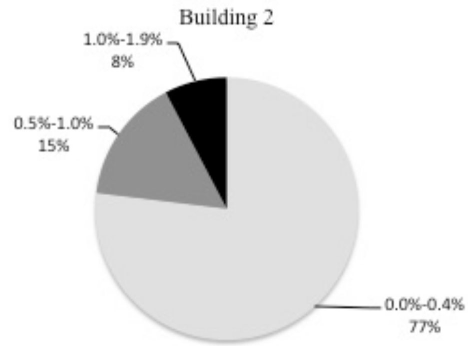
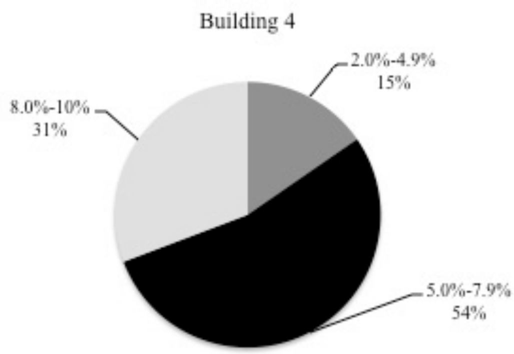


Figure 6.6. Annual electricity cost share of HH income, Building 4.



DISCUSSION

The results above lead to a more nuanced understanding of the role of income on energy consumption among renters. The two buildings have similarly sized apartments and a range of family sizes, with more single and two-person households in Building 2. The expectation is that Building 2 would consume at least an approximately equal amount of electricity as Building 4 given its high level of energy efficiency and green features, and given the two buildings' similar scoring on the organizational criteria developed in Chapter 3. However, the findings indicate that Building 2 consumes more energy overall, and Building 2 residents consume far greater amounts of electricity than Building 4 residents. This illustrates that income as a predictor of consumption can override both highly efficient building features *and* highly centralized and controlled building operations at the organizational level.

This chapter argues that low-income individuals usually cannot afford as many amenities, hence tend to live in less energy-consumptive apartments. Low-income individuals additionally evidence a higher level of attention to price signals, out of necessity. These two types of thrift together yield less energy use. Conversely, high-income individuals choose higher-amenity apartments with many energy consumptive features and appliances. Additionally, they tend to ignore weak energy price signals (perhaps unless they have strong environmental motivations). Thus, efficiency features of their dwellings and appliances generally do not offset their higher energy consumption.

Renters and Consumption

As discussed earlier, rental buildings present a special case, and are, in many ways, the flip side of cooperative buildings.

First, much of the electricity usage in a given apartment is "built in" to a residence. Rental buildings vary in the extent to which they are designed for occupant control of energy consumption. Many buildings, such as Building 2, allow resident control of plug-load only. Infrequently, others also offer additional control of heating and cooling systems. In the case of Building 4, there is no centralized air conditioning system; thus, residents make choices about window air conditioning unit usage during summer months, which greatly impacts metered household electricity usage.

Next, rental buildings face principal-agent issues that cooperative buildings are able to avoid. This relates to the role of residents as organizational customers in rental buildings, not organizational decision-makers, or full members as in cooperative buildings. In luxury buildings, customers are highly demanding. As such, the role of the management organization becomes even more important, but as we see here, even a strong rental company cannot override the importance of income in driving consumption.

In the case of a comparison of these two buildings in particular, where incomes vary greatly, energy bills are a larger fraction of monthly income for low-income residents than high-income residents and, as a result, some household energy consumption is income-elastic and highly determined by income and affordability, not lifestyle or conservation goals.

Data from Figure 6.4 illustrate this. Building 2 residents have far less concern about extra cost and expense given the minor portion of income the electricity bill represents for these residents; hence, even those residents that consume less electricity in Building 2 may or may not have reported one of the lower income categories and may or may not have reported it was important to avoid extra expense. Building 2 occupants are much less constrained; their patterns of consumption illustrate this, as self-reports do not closely match kWh data and there is a high level of variability in consumption, income and importance of avoiding extra cost. Residents of that building are making consumption decisions based on routine, habit, lifestyle, comfort, or other preferences. In Building 4, however, occupants face much higher burdens on income from electricity bills and, as a result, their consumption is highly constrained. They have less control over their consumption because much of their usage is determined by cost and affordability. This disparity in income and cost of electricity in the two study buildings points to the differing importance in price signals in each location and the different decision making factors residents will weigh regarding electricity. Anecdotal survey and interview data from both buildings is helpful in shedding additional light on this. It was observed during on-site data collection that some residents of Building 2 make choices about electricity usage strictly for convenience or comfort; for instance, one resident kept the television on frequently for the dog. Building 4 residents reported taking more actions to conserve electricity in order to save money, such as making careful choices about the use of the air conditioner during summer. Building 2 residents also own a host of higher end appliances in their apartments. Of the 161 respondents from the full-building survey, 20% own and use a wine cooler; 17% own a humidifier, 86% own a laptop, and 48% own an electric coffee maker. In Building 4, no respondents own a wine cooler or humidifier, only 60% own a laptop, and only 27% own an electric coffee maker.

Policy Implications

This research suggests two policy implications and one broader implication for the field of practitioners and building designers. First, programs should be crafted to allow low-income residents more affordable access to energy efficient appliances and high performing buildings. Not only will these amenities help reduce the monthly electricity burden for poor households, but they are likely to be successful in reducing consumption. Although some affordable housing developers are incorporating green features, green buildings are overwhelmingly a luxury product. It should be cautioned that as consumption becomes more affordable for low income residents, the rebound effect is likely to be stronger, thereby offsetting some of the efficiency improvements.

Secondly, management organizations need to think more creatively about how to engage high-income residents in conservation efforts; if they are less likely to respond to price signals because of the low burden electricity places on income, mechanisms such as peer pressure or social media campaigns need to be considered. For example, OPower is a Virginia- and San Francisco-based company that partners directly with utility providers to send home energy reports in monthly bills that compare a customer's usage to that of "nearby neighbors" as a means of increasing awareness of consumption, fostering competition, and activating social norms (Allcott, 2011; OPower, n.d.). Allcott notes approximately a 2-4% reduction in consumption simply through the monthly inserts (Allcott, 2011). For consumers like those in Building 2, schemes such as these may provide alternative means of engagement.

Finally, for practitioners and building designers more broadly, the role of green residential buildings should be carefully explored. Although green buildings offer many benefits beyond energy efficiency, they should not be viewed as the panacea for reducing consumption across the board among occupants. In particular, as these results indicate, if occupants have very high incomes, they may override any well-intentioned green features. At the design stage and during the planning process, energy models should attempt to incorporate an accurate picture of the end user and the particular customer market the property intends to attract in order to develop a more comprehensive prediction of building performance. Agent-based modeling could be a good solution to help better predict how individual agents of differing incomes, preferences, and patterns of behavior might consume electricity (Andrews, Yi, Krogmann, Senick, & Wener, 2011). If management companies want to lessen consumption in individual apartments, but fear upsetting tenants or losing residents, options should be considered that automate some functions in households. Many "smart buildings" are heading in this direction already, and from an organizational perspective, features such as these may give environmentally-inclined management companies more control over in-apartment consumption without sacrificing resident satisfaction or happiness with their unit.

It should be acknowledged that there are some limitations to the data given the different n-sizes of the two buildings. A larger sample size in Building 4 that more closely correlates to that of Building 2 would allow a more robust statistical analysis. Additionally, the research would benefit from subsequent studies in additional buildings.

CONCLUSION

This research explored the role of household income in driving energy consumption, even in the presence of organizational characteristics that were expected to help the owner organization implement and enforce energy efficiency measures. This section questioned the effectiveness of high-performing green building if occupants have high incomes and little incentive to save.

Findings indicated that low-income individuals are unable to afford as many amenities and appliances, which leads to decisions to locate in what are typically less energy-intensive apartments. Further, they are more likely to respond to price signals due to the heavy burden the electricity bill places on their monthly budget. Conversely, wealthier individuals tend to locate in amenity-rich apartments with technologies and features that collectively consume more energy. Additionally, they generally ignore weak price signals, as the electricity bill places little burden on their monthly budget, allowing preferences for comfort and convenience to drive consumption decisions. Energy efficient appliances and other green building amenities in the homes of high-income residents are unlikely to offset their significant consumption.

The findings helped highlight the need for two policy recommendations – better access to high-performing buildings and energy efficient appliances for low-income households, and stronger, more creative incentives at the organizational level – including potentially more building automation – to engage high-income individuals to conserve electricity at home.

CHAPTER 7
CONCLUDING FINDINGS AND DISCUSSION

INTRODUCTION

This work has reviewed a number of ideas and hypotheses to support the premise that buildings can, and do, function as organizations, and that this approach may be helpful for understanding and motivating energy efficiency within the building. This concluding section will revisit the primary research questions and main hypotheses under inquiry here, the research conducted to explore these questions and hypotheses, and main findings from each section. It will conclude with a broader assessment of the success of this endeavor, policy implications, and next steps for future research.

REVISITING RESEARCH QUESTIONS AND HYPOTHESES

We can recall from Chapter 1 that one primary research question was presented as the main point of inquiry, under which three sub-questions were nested. These 4 research questions set the stage for a set of five hypotheses.

The research questions asked, first, what organizational criteria were important in conceptualizing buildings as organizations. The hypothesis arising out of this primary question was that all buildings function as organizations. This question and hypothesis were explored in Chapter 2, and this analysis relied on organizational literature, site visits to buildings, and interviews with members of the residential building community.

Once it was established that buildings can, and do, function as organizations, and a set of organizational characteristics were outlined that translate well to buildings, the next sub-question attempted to extend these characteristics to energy efficiency. It asked if specific types of building organizations might be more likely to implement energy efficiency initiatives. To answer this question, the hypothesis was posed that the strength or presence of specific organizational characteristics give a building an organizational advantage, making it easier to suggest, implement, manage and/or maintain energy efficiency upgrades, initiatives, or improvements. To analyze actual buildings in this regard, the organizational characteristics presented in Chapter 2 were given an energy efficiency scale, and each building was given a score based on its organizational criteria. This question and related hypothesis was explored in Chapter 3, and relied on literature, interviews, site visits, and full-building energy disclosure data.

Following from the qualitative energy efficiency analysis in Chapter 3, the next sub-question asked if particular organizational characteristics contributed to *actual* reduced energy consumption. Building on Chapter 3's work, this next question advanced a related hypothesis that argued that ownership type is an important organizational factor in determining consumption, and that cooperative buildings in particular are likely to be more energy efficient because the cards are heavily stacked in favor of an organizational advantage that makes energy efficiency easier. This question and hypothesis took a quantitative approach, and relied on two large New York City datasets, which were analyzed in Chapter 4.

Finally, the last sub-question asked if some of these seemingly important organizational characteristics could be studied empirically. This final question put forth two remaining hypotheses. First, that decentralization is one important organizational factor in driving energy efficient decision-making, but that not all ownership types can (or should) be decentralized. Cooperatives, it was argued, are particularly decentralized, leading to a predicted higher level of efficiency. This hypothesis arose out of findings about cooperative buildings in Chapter 3 and Chapter 4. This hypothesis was explored in

Chapter 5 through the case study of a small Brooklyn cooperative building, and relied on mixed methods of survey and interview data collection. The second hypothesis arising out of the final research question posed the argument that, indeed, not all ownership types can (or should) be decentralized. In particular it argued that rental properties, on the flip side of the cooperative findings, may need a higher level of centralization in order to implement efficiency initiatives when building occupants are customers and not decision-makers. This question was explored in Chapter 6, where the whole-building energy use and household consumption of two rental properties were compared along with indicators about household income in order to further test the effectiveness of highly centralized management and highly efficient buildings.

The main findings from each of these questions and hypotheses will be discussed in turn.

DISCUSSION OF MAIN FINDINGS

H1: Buildings as Organizations

First, the preliminary hypothesis (H1) established that buildings can, and do, function as organizations, but that extending organizational characteristics to buildings takes some tailoring and modification. This section outlined 6 primary organizational characteristics and 2 building characteristics (that act organizationally) that shape buildings as organizations. These 8 organizational characteristics and their corollaries in buildings are:

- Organizational structure → Ownership type → Rental, condominium, or cooperative
- Organizational boundary →Building-organizational boundary → Expansive, moderate, or contained

- Organizational size → Building size (number of households) → Small (fewer than 25 units), medium (25-100 units), or large (over 100 units).
- Organizational decentralization → Building decentralization → Low, medium, or high
- Organizational culture → Building goal → Profit, resident retention, efficient operations, energy efficient operations, community engagement
- Member role → Resident role → Customer, stakeholder, decision-maker (full member)
- Employee tenure → Resident tenure → Short-term, medium-term, or long-term
- Building status (level of amenities + level of service) → Standard, moderate, or luxury

I argue that Hypothesis 1 is well established through this analysis of literature and related fieldwork. Buildings can be strongly conceptualized as buildings, and many organizational characteristics translate very well to buildings. Some follow-up work could delve more deeply into the application of this typology to additional "real" buildings in New York and other cities to lend weight to the empirical application of this system.

H2: Organizational Advantage and Energy Efficiency

Hypothesis 2, in which it was argued that some organizational criteria give buildings an organizational advantage in implementing energy efficiency, scored 7 of the study buildings using a system based on the eight criteria outlined above. This scoring exercise indicated few important outcomes about the use of this system to characterize buildings as energy efficient or not.

First, it was found that the study buildings did not always perform as scored (e.g. the lowest scoring buildings were not the worst energy consumers, and the highest scoring buildings were not the most efficient energy performers). While the top scoring building (Building 9) did also consume the lowest amount of energy of the 7 buildings, this was not the case across the board. In particular, three rental properties performed rather well (Buildings 1, 4, and 7), with rental Buildings 1 and 7 performing much better than expected. One condominium building (Building 8) performed much worse than expected.

Some explanations for these outcomes were posited. First, it was explained that given the good match-up of the one cooperative building's low EUI and high organizational score, some of the organizational characteristics that seemed beneficial to the energy outcomes of cooperative buildings are highly relevant and merit further study. Also, it was posited that although some of the rental properties were given poor marks for decentralization, rentals might in fact be an organizational type that benefits from some measure of centralization (holding all else equal and given the presence of the other rental building organizational criteria, such as residents as customers). Overall, it was determined that ownership type, as a key organizational variable, seemed to be important to the scoring outcomes and related consumption of these buildings and, as such, would be studied further.

H2 was not conclusively proven, but evidence indicates that there was some merit in undertaking the scoring exercise. The idea of an *organizational advantage* seems to hold true, as some characteristics are clearly important, but what is unclear is the relative weight of some characteristics over others and the importance of some combinations of characteristics. What was particularly insightful was the fact that context will almost always drive building outcomes, so although generalities can be made, no categorization or scoring system is likely to ever capture conclusively all of the important characteristics of a building that determine its likelihood of engaging in energy efficiency. Thus, H2 was partially advanced.

H3: The Importance of Ownership Type

Hypothesis 3, which put forth the idea that ownership type more broadly and cooperative buildings in particular are likely to drive energy efficiency, was examined using LL84 and PLUTO data in a combined dataset along with new ownership variables. Findings from this exploration indicated that, quantitatively, cooperative buildings in New York City perform much better *citywide* than other types of multifamily residential buildings, holding all else equal. The analysis also found that rental buildings in general and public housing (rental) developments in particular consumed more energy than other types of multifamily residential buildings, holding all else equal. The role of condominium ownership type on energy consumption was inconclusive.

Given this analysis, H3 was well established. Ownership type, which this hypothesis set out to explore, is a particularly relevant variable in determining building energy outcomes in the New York City multifamily building stock. However, the particular outcomes regarding cooperatives while well supported were not conclusively proven. Thus, cooperative buildings were explored in more detail in the case study in the following chapter.

H4: Cooperatives are Highly Decentralized

The next section put forth the hypothesis that part of the energy-efficiency success of cooperative buildings is due to key organizational characteristics, namely, that cooperative buildings are highly decentralized, and that this decentralization leads to a high level of transparency of decision-making, proximity to decision-making and perceived control to make change. This hypothesis was explored in Building 5, where multiple interviews and a building-wide survey were conducted to gather information about this one cooperative in particular. Findings indicated that this particular property was indeed highly decentralized, and that residents of this building found the decision-making process visible (indicating transparency), knew the decision-makers or were themselves the decision-makers (indicating proximity), and were generally aware of how they could offer input, change things themselves (e.g. by buying supplies if needed and getting reimbursed) or vote on new initiatives (indicating perceived control).

It was also found that the building was highly proactive in investing in energy efficiency initiatives – over the years they have upgraded the boiler, switched to dual fuel operations, installed more efficient windows, switched to energy efficient lobby light bulbs, installed heat computers to better regulate heating and temperature in the building, started composting, and now use green cleaning products. Surprisingly, despite this long list of initiatives, nearly every resident reported that the building either did not have a culture of conservation or encourage energy efficiency, or that they didn't know if it did or not.

A major finding from this work was that much of the impetus for these energy efficient capital improvements came from a long-standing resident and board member who also serves as the board treasurer. It was determined that not only was he a driving force behind the installation of many of these initiatives, but that his narrative of cost-consciousness (and not environmental concern) was passed along to building residents, shaping their perception of what the building has done and why. This also led to a new finding about leadership: Despite the high level of decentralization in the building, strong leadership is still an important organizational characteristic, and its importance (and ability to impact outcomes) becomes especially visible in this exploration.

Thus, H4 was fairly well established. It indicated that decentralization is an important presence in this building, and that it likely helped shape levels of transparency, proximity, and perceived control. However, given that this building is very small, it is difficult to say with certainty if these findings will hold in all cooperatives or even in similar cooperatives, or if they are a result of this building's small size. The existence of a long-standing board treasurer who happens to be cost-conscious and not averse to making long-term capital improvements is also unique to this building and this building alone. In addition, although decentralization can be deemed important, it is not clear if characteristics such as decentralization, transparency, proximity and perceived control have any bearing on an energy efficiency inclination, per se. Perhaps they simply facilitate collective decision-making but, as we have seen in this building, the outcomes of that decision-making may vary greatly based on the organizational leadership.

H5: Rental Buildings Need Centralization

The final hypothesis posited that, despite the earlier argument that decentralization would serve a building organization best, some building organizations might be better served by some measure of centralization instead. Indeed, earlier findings from H2 and H3 found that rental properties needed further exploration, and that perhaps decentralization in instances of residents-as-customers (and when principal-agent issues would be most prevalent) was not the best organizational configuration, as these organizations especially need leadership in order to implement energy efficiency initiatives. Work from the comparison of Building 2 and Building 4 highlighted a number of interesting findings. First, from an organizational perspective, both of these buildings are fairly centralized and have a number of management-led initiatives for energy efficiency and environmental friendly living (with Building 2 having more capacity and organization at the central building management level). Both buildings scored nearly the same on the organizational criteria outlined in Chapter 3, with the key distinction being the level of building status (amenities and service collectively). Building 2 is a luxury building and, as such, has a high level of amenities and services for residents, and is a key example of residents playing the role of (somewhat demanding) customers, with high expectations for lifestyle. From a household perspective, Building 2 residents have very high incomes and pay very little for electricity (relative to their income), while Building 4 residents are low income individuals who pay a significant portion of their income (often in the 10% range) for electricity.

From an energy consumption perspective, Building 2 consumed much more energy on a whole-building basis (using annual disclosure data) than Building 4. Building 2 also consumed far more energy at the household level (using monthly kWh data) than Building 4.

These findings indicate that the high level of centralization and leadership at the management level in Building 2 (which has more capacity and resources than Building 4), coupled with the highly efficient green features of this LEED platinum property were not enough to override the consumption patterns of the high-income residents. Thus, returning to the organizational criteria scoring, building status (the one area where the two buildings differed most) is now deemed even more important.

In light of these findings, H5 was not conclusively established. It makes sense that rental buildings would benefit more from leadership, control, and centralization than other types of buildings, but other factors are at play that merit further study. In particular, new findings arose from this section that highlighted just how impactful highly consumptive residents can be, and this pattern of high consumption is strongly linked to income. This links back to the strong economic considerations mentioned in earlier sections of this writing. The sociological aspects of buildings as organizations cannot be studied in isolation without also giving attention to price signals, income elasticity and potential rebound effects. These considerations may play out more strongly in some buildings than in others – as in Building 2 – but they play an important role in determining consumption. Along those lines, one area where the sociological and economic tension becomes highly visible is in the discussion of centralization in Buildings 2 and 4. A distinction should be made between centralized control at the building operations level, and centralized price signals (which lead to decentralized decision-making at the individual agent level). Both touch upon organizational aspects of building operations, but focus on different incentives for behavior and different actors.

RELEVANCE, IMPLICATIONS AND FUTURE RESEARCH

A number of relevant summary points should be addressed. First, and most broadly, the exercise throughout this work of conceptualizing buildings as organizations was a fruitful one, and led to a number of new ways of understanding and exploring the relationships, decision making, and actors in urban residential buildings. Some of these new conceptualizations may help us better understand energy efficiency, while others may not; nevertheless, research on buildings can benefit from new approaches, and this work offers one such approach.

A number of the findings here were limited in their ability to conclusively support the hypotheses put forth, or led to new findings that were not anticipated and merit further research. Thus, a number of studies come to mind as potential future explorations to extend this work.

First, more work in cooperative buildings is needed. In particular, work in larger buildings or in multiple buildings would be helpful in better understanding some of the organizational characteristics at play here. New York City has more cooperative buildings than anywhere else in the U.S., and no work has been done connecting the social and organizational aspects of co-ops (mostly advanced by Low et al.) with the energy questions being explored here. Cooperative building residents are also highly self-selecting, which likely results in more homogeneity than other building types. This should be explored further. Also, although the findings here are interesting, they are also very New York-centric, since New York City's cooperative market is so well established and long-standing. How might this ownership configuration play out in other cities? Building on this, there also exist even more extreme examples of cooperative housing; these commune or co-housing situations explicitly seek out social living and working arrangements. These types of communities would serve as an interesting comparison to the cooperative building findings presented here.

Next, this work began to touch upon some initial findings in condominium buildings; namely, that although they would be expected to more closely follow the performance of cooperative buildings, disclosure data does not offer supporting evidence for this, and the qualitative analysis of 7 buildings in Chapter 3 found the condominium to be the worst energy consumer of the entire sample. One could hypothesize that condominium buildings more closely resemble rental properties, not cooperatives, in that they have little control of energy use in individual units, and play only a marginal role in day-to-day decision making, showing concern mostly for their own unit. No other case study buildings with condominium ownership were available for this study, but that could also be a good avenue for a future study.

Additionally, further work to explore themes of leadership would be highly relevant given the findings in both Chapters 5 and Chapter 6. Chapter 5 illustrated the role of strong leadership in a cooperative organization in driving initiatives, narratives, and outcomes in the building. Organizational leadership was also a factor in Chapter 6 in the comparative analysis of Building 2 and Building 4, where we saw evidence of highly organized and engaged management in Building 2 that was still not effective in bringing consumption down to a more moderate level. Can this leadership be better leveraged in these types of buildings? Although leadership in organizations has likely been well studied in the organizational literature, applying it to building organizations and the specific question of energy outcomes opens up a new direction for this work.

Finally, Chapter 4 only began to touch on the vast potential and richness in the New York City disclosure data. This data is still very new by research and policy standards, and is fast becoming a tool of choice for many big cities. New York City is leading the way both in number of buildings reporting energy use and in work being done on the existing datasets, but there is much more work to be done. First, as mentioned in Chapter 4, adding more information to the regression analyses to account for average energy prices would strengthen the research presented here. Additionally, no cities seem to know, at this point, how or if this data is being (or will be) used by owners or managers to inform building operations in the future. Will owners begin to track their own performance over time? Will they begin to pay attention to "peer buildings" or major competitors? The large laboratory that is New York City offers the potential to explore these and other questions. From an organizational perspective, many aspect of the organizational typology developed here for buildings can be viewed as important or interesting for study along with this dataset. From a social science perspective, much of the work presented here – which offers mixed methods, and more contextual survey and interview data along with statistical analyses – can offer a strong complement to the current quantitative-heavy work being done with the New York City disclosure data.

The above ideas highlight a few interesting next steps for extending this work in new directions. Ultimately, this work attempted to extend an organizational line of thinking to a residential context in order to provide a new approach to understanding multifamily building energy efficiency.

APPENDIX A

INTERVIEW PROTOCOL: RESIDENTIAL BUILDING COMMUNITY

Q1: Please describe your role in the residential building community.

- What building(s) do you work or live in?
- What neighborhood(s) are they located in?
- How long have you worked or lived in this building and/or neighborhood?

Q2: If you had to describe the building, what adjectives first come to mind?

Q3: How long would you say residents typically remain occupants of the building?

Q4: Do you think people form attachments to their building (beyond just their individual apartment unit)? If so, why? What unique things does the building add to people's lives?

Q5: Does the building offer any sort of social programming for residents? If so, what kinds? Do many people participate?

Q6: (FOR RESIDENTS ONLY) How well would you say you know your neighbors? How much interaction do you have with them? And how far does this interaction extend in the building (e.g. only people immediately next door, only people on my floor, or people all over the building because we see each other at social gatherings in the building)

Q7: (FOR BUILDING MANAGERS ONLY) How much interaction do you typically see among residents in the building? Does the building do anything to encourage more interaction? Why or why not?

Q8: Are there any informal groups or organizations that have formed among residents in the building to address collective issues or enjoy a shared hobby?

Q9: If you had to rank yourself on a scale of 1-10 in terms of how important resource conservation is to you (at home/in the building) what would your score be?

Q10: How about electricity conservation in particular?

Q11: How important would you say resource conservation is to ***others*** in the building? How about to others in your life (e.g. friends/family/people close to you)?

Q12: Would you say there is a "culture" of conservation here? If so, how has that culture been formed and nurtured and developed over time?

Q13: Do you care what other people in the building think about your recycling habits, or how you use electricity or other resources at home?

Q14: If I suggested that the building might be a unique "social unit" – an entity that physically bounds people in space and creates special interactions and patterns of behavior within its walls – would you agree or disagree with me? Why?

APPENDIX B

BUILDING 5 SURVEY PROTOCOL

(MODULE PART A: BUILDING MODULE)

QA1: How long have you lived in your current building?
1. Less than one year
2. 1-2 years
3. 3-4 years
4. 5 years or more

QA2: What is your apartment type?
1. Studio
2. 1 bedroom
3. 2 bedroom
4. 3 bedroom
5. Other (please describe) ____

QA3: How often would you say you interact with other residents in your building?
1. Never
2. 1-2 times a month
3. 1-2 times a week
4. Every day

QA4: Do you agree or disagree with the following statements:
- I have formed a strong friendship with at least one person in the building
- I have formed casual acquaintances with many residents in the building.
- My building encourages me to get to know my neighbors through social activities, shared spaces, projects in and around the building, and other on-site activities.
- I feel a sense of connection and belonging to my building.
- I am aware of decisions that are made for/about my building by the co-op board.
- I am included in the decision-making of the building.
- My opinion matters in the decision-making of the building.

Response Choices:
1. Strongly agree
2. Agree
3. Neither agree or disagree
4. Disagree
5. Strongly disagree

QA5: How important are the social ties you have in your building?
1. Less important than the social ties you have outside of your building
2. About the same as the social ties you have outside of your building
3. More important than the social ties you have outside of your building

QA6: Do you currently or have you previously served on the board of your building at some point during your time as a resident?
1. Yes

2. No

(If QA6 = 1)
QA7: What position did you or do you currently hold on your board and when did you hold this position?

____

QA8: How well do you feel you know the board members in your building:
1. I don't know them at all
2. I know them a little
3. I know them very well

QA9: Would you like to have more input, less input, or about the same amount of input as you do currently in the decision-making of the building?
1. I would like more input
2. I would like less input
3. I am satisfied with my current amount of input

(END OF PART A: Respondent hits *next* button)

(MODULE PART B: ENERGY & CONSERVATION)
This next set of questions asks you about your opinions on energy efficiency and conservation in your apartment and building.

QB1: How often would you say you make a conscious effort to save energy at home?
1. Never
2. 1-2 times a month
3. 1-2 times a week
4. Every day

(IF QB1 = 1, 2, OR 3)
QB2: What is the *most* important reason why you try to save energy at home? Select one.
1. To save money on my monthly electric bill
2. To set a good example for my family, children, or other people I live with
3. To avoid being wasteful
4. To do my part to help lessen energy consumption in my building
5. To reduce climate change or lessen environmental impacts
6. Other (please specify) ______________________________________

QB3: Does your building (the board, the super or manager, other residents) actively try to encourage conservation of resources like water and electricity?
1. Yes
2. No
3. Don't know

(IF QB3=1) QB4: How does the building go about encouraging conservation?
1. Sharing information (emails, flyers up in mail room, etc.)
2. Training programs
3. Special events for residents (efficient light bulb giveaways, other)

4. Financial incentives or penalty (a rebate or a common area electricity/water charge that all residents must pay)
5. Other (please describe)____

QB5: Would you agree or disagree that there is a "culture" of conservation in your building?

1. Strongly agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly disagree

QB6: How much would you say you care what other people in the building think about your recycling habits, or how you use electricity or other resources at home?

1. I do not care at all
2. I care a little
3. I care a lot

(END OF PART B – Respondent hits *next* button)

(MODULE PART C: DEMOGRAPHICS)

This last set of questions asks for some information about you and your household.

QC1: What is your age?

1. 18-25
2. 26-30
3. 30-39
4. 40-49
5. 50-59
6. 60-69
7. Over 70

QC2: Which of the following best describes your political views?

1. Very liberal
2. Somewhat liberal
3. Moderate
4. Somewhat conservative
5. Very conservative
6. Other _______________

QC3: What is the highest level of education you have completed?

1. High school
2. Some college
3. Associates degree
4. Bachelors degree
5. Graduate school -- Masters degree, MBA, JD, PhD or MD

QC4: What is your approximate household income?

1. Under $50,000/year
2. $50,000-$99,999/year

3. $100,000-$149,999/year
4. $150,000-$199,999/year
5. $200,000-$249,999/year
6. $250,000-$299,999/year
7. Over $300,000/year

QC5: Are you –
1. Male
2. Female

QC6: How many total people live in your home (including yourself)?
1. 1 person
2. 2 people
3. 3 people
4. 4 people
5. 5 or more people

(END) You have reached the end of the survey. Thank you for your participation!

Click here to submit your survey.

(NEXT PAGE)

If you would like to be entered into the drawing for a $50 Amazon gift card, please enter your email address below:

Please note, email addresses will only be used to select a random winner of the gift card. They will not be stored with or connected to your survey responses, which will remain confidential. Email addresses will not be saved or shared for any reason whatsoever, and will only be used to select a winner for the gift card.

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