Increasing Homeowner Demand for Energy Efficiency Retrofits: Recommendations for the North Carolina Building Performance Association

By

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## Recommendations

### Consumer Education

**Recommendation 1:** Bolster HomeEnergyNC website and continue working with stakeholders to increase website impact.

### Market Valuation

**Recommendation 1:** Create a position within the association dedicated to full time data collection and management.

**Recommendation 2:** Push for Home Energy Score adoption throughout the state to establish baseline understanding of third-party verification.

**Recommendation 3:** Create a real estate working group to make concerted efforts toward “greening” the MLS.

### Marketing

**Recommendation 1:** Employ a conjoint marketing approach.

**Recommendation 2:** Emphasize demographics to align marketing efforts to target audience.

### Finance

**Recommendation 1:** Promote on-bill financing in North Carolina by joining the North Carolina On-bill Working Group and working to diversify capital funding from the federal government, local electric cooperatives, and credit unions.

**Recommendation 2:** Continue efforts to promote commercial PACE financing to pave the way for residential PACE.

### Conclusion

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Abstract

With rising concern aimed at energy consumption and its environmental impacts, efforts are being made to conserve energy across the United States. Nearly half of all domestic energy use is dedicated to homes and buildings. Despite significant strides by the homebuilding industry to design new energy efficient structures, a significant portion of the current housing stock includes inefficient, poor-performing homes. The North Carolina Building Performance Association (NCBPA) tasked us with identifying the barriers preventing homeowners from investing in home energy retrofits and offering pertinent recommendations to address these roadblocks. Through an exhaustive review of current literature and key insight from industry leaders, we distilled the many barriers into four areas: consumer education, home valuation, financing, and marketing. Our recommendations include building-out NCBPA consumer education website, hiring of a full-time data manager to create an inventory focused on capturing metrics surrounding home valuation, developing a conjoint marketing plan to target specific audiences, and continuing to push for commercial PACE and on-bill financing in North Carolina.
Executive Summary

Americans demand a great deal from their homes, and the amount of electricity needed to meet these demands is both massive and costly. Furthermore, the energy resources required to generate the requisite electricity stress our supplies and present challenges for environmental stewardship. Consequently, effectively managing home energy through increased efficiency and performance remain at the forefront of energy-related discussions in the United States. Advances in construction innovation and technology have allowed homes to achieve greater levels of efficiency and higher levels of performance in the past few decades. In some locations, based on political environment, utility company participation, and regulatory atmosphere, homeowners are provided incentives and exposed to regulations encouraging green home building and home energy retrofits. Green builders and contractors, non-profits, private organizations, and others have also helped catalyze a transition toward saving energy and money in the building sector. However, despite these advancements, a staggering proportion of existing homes are underachieving. U.S. homeowners are confronted with a number of barriers preventing or discouraging them from taking steps toward achieving higher performing homes. Our project focuses on identifying the barriers confronting homeowners in North Carolina and makes recommendations aimed at addressing them in an attempt to promote energy efficiency retrofits in the state’s existing homes.

The first section of this report serves as an introduction to home energy use in the United States. It provides background on the emergence of green building and describes the energy efficiency retrofit process. In this discussion, the many industry stakeholders involved in the investment and renovation chain are identified and their specific roles are clarified. The first section concludes with an introduction to the client, the North Carolina Building Performance
Association (NCBPA), and an exploration of the current status and evolution of North Carolina’s home performance industry.

The second section focuses on research methods employed throughout the analysis. The overall objectives and scope of the project are enumerated. Specifically, this section details the process used to execute the comprehensive literature review and how a set of relevance criteria was used to identify and assess the most useful available sources. Intermediate deliverables, including an exhaustive literature review table and a prioritization of retrofit barriers, are also described.

The third section centers upon the results of the initial literature search. It provides a long list of home energy efficiency retrofit barriers and distills them into four main barrier areas. These areas are: holes in consumer education, suppressed home valuation, financial hurdles, and improperly aligned marketing strategies.

The fourth section consists of the literature review discussion and makes up the bulk of the report. This section introduces the four main barriers and assesses their significance within North Carolina. Each barrier discussion is followed a review of a multitude of sources found to be related to the topic. The sources are thoroughly summarized before lessons learned and strategies for overcoming barriers are highlighted.

The last section of the report presents recommendations. Here, actions are proposed to NCBPA to address and reduce the barriers preventing increased homeowner demand for energy efficiency retrofits in North Carolina. The report establishes the final recommendations:

1. Create a position within the association dedicated to full time data collection and management.
2. Push for Home Energy Score adoption throughout the state.
3. Create a real estate working group dedicated to “greening” the MLS.
4. Encourage on-bill financing in North Carolina.
5. Continue efforts to promote commercial PACE financing to pave the way for residential PACE.
6. Bolster the HomeEnergyNC website and continue working with stakeholders to increase website impact.
7. Employ a conjoint approach to marketing efforts.
8. Emphasize demographics to align marketing efforts with the target audience.

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Introduction

Americans demand a great deal from their homes. These structures provide power for lighting, winter warmth, summer cooling, water heating, and refrigeration, as well as a source of power for appliances and electronic entertainment. The amount of electricity required to meet these demands is both massive and costly. Furthermore, the energy resources required to generate the requisite electricity stress our supplies and present challenges for environmental stewardship. Consequently, effectively managing home energy through increased efficiency and performance remain at the forefront of energy-related discussions in the United States. Advances in construction innovation and technology have allowed homes to achieve greater levels of efficiency and higher levels of performance in the past few decades. In some locations, based on political environment, utility company participation, and regulatory atmosphere, homeowners are provided incentives and exposed to regulations encouraging green homebuilding and home energy retrofits. Green builders and contractors, non-profits, private organizations, and others have also helped catalyze a transition toward saving energy and money in the building sector. However, despite these advancements, a staggering proportion of existing homes are underachieving. U.S. homeowners are confronted with a number of barriers preventing or discouraging them from taking steps toward achieving higher performing homes. Our project focuses on identifying these barriers confronting homeowners in North Carolina and attempts to make recommendations toward addressing them. We begin by discussing both a broad view on home energy use and how this intersects with the clean energy and construction industry. This is followed by a section dedicated to describing the methods undertaken to identify and offer solutions to current barriers. Our results section relegates the barriers into four general categories
(consumer education, home valuation, marketing, and financing) before breaking them down in more detail in our discussion section. Finally, this is followed by recommendations designed to address the four barrier categories.

**Home Energy Use.**

Today, homes and buildings in the U.S. consume far more energy than both the transportation and industrial sectors. According to the U.S. Energy Information Administration (EIA), buildings in the U.S. consume approximately 45 quadrillion BTUs (Quads) of energy annually (Figure 1), whereas the transportation and industry sectors consume about 27 and 23 quadrillion BTUs, respectively (2013). This equates to nearly half of all of the energy consumed in the U.S. in a given year. In terms of electricity use by sector, nearly 75 percent of all electricity produced in the U.S. goes toward building operations with about 25 percent dedicated to the industrial sector and the remaining less than 1 percent dedicated to the transportation sector (Figure 8 in Appendix A). Considering greenhouse emissions, the building sector is responsible for nearly half of all CO₂ emissions (45 percent), while the transportation and industrial sectors account for 34 and 21 percent of all emissions, respectively (Figure 9 in Appendix A). Of the energy used in homes and buildings, the majority (about 74 percent) comes from non-renewable resources such as coal, natural gas,
and petroleum. Only 9 percent of the energy used in the U.S. buildings sector comes from renewable energy sources with another 16 percent coming from nuclear (U.S. Department of Energy, 2012). This largely conventional energy mix illustrates how conservation methods or evolution of the energy mix could result in dramatic energy savings for homes and buildings. The magnitude of energy consumption, electricity use, and greenhouse gas emissions make the building sector an obvious candidate for vested improvements. Attention placed in this sector resulting in increased building performance and energy efficiency represents both environmental and financial opportunities.

After the financial crisis of 2008, energy efficient homes became more popular for new construction. Homes today boast a variety of upgrades over homes built before the turn of the century. Some of these include improved air sealing, improved insulation quality, high-performance windows, efficient heating and cooling equipment, and advanced lighting. These physical upgrades, improved building materials coupled, and the improved best practices of homebuilders ushered in a higher standard of homebuilding. Homes are increasingly more efficient. As shown in Figure 2, heating and cooling no longer use a majority of home energy.
This indicates an improvement in home efficiency but also a general shift toward greater use of electronics and home appliances. The EIA's Residential Energy Consumption Survey shows a shift in geography —53 percent of new homes are in the temperate South (2013). This geographical shift also explains the increased use of air conditioning. New homes showed a greater degree of appliances such as dishwashers, clothes washers and dryers, and two or more refrigerators. They also have more entertainment devices such as TVs, video game consoles, and more. Compared with older homes, newer homes used about 18 percent more energy on average in 2009 for appliances, electronics, and lighting than older homes (2013). However, U.S. homes built from 2000 onward consume only 2 percent more energy on average than homes built prior to 2000, but are on average, 30 percent larger (2013). This indicates an overall increase in energy efficiency and building performance. At the more efficient end of the homebuilding spectrum are the “green” homes.
The Emergence of Green Building.

A number of factors account for the rise in green building. Its roots can be traced to the environmental movement, which began in the 1960s and 70s, spurred in part by the spike in oil prices in the 1970s and a growing environmental consciousness that championed conservation, stewardship, and a transition to renewable energy sources. Formal attempts toward developing environmental standards began in the early 1970s which ushered in the U.S. Environmental Protection Agency (EPA) which introduced the ENERGY STAR™ label for new residential homes in 1995; the U.S. Green Building Council (USGBC) which founded Leadership in Energy and Environmental Design (LEED) standard in 1998; and the National Association of Home Builders (NAHB) which coined the term “green building” in the late 1980s. Although green building emerged as early as the passive solar design initiatives of the 1950s, it remained rather pigeonholed until after the turn of the century.

The U.S. real estate bubble affected the housing market when home prices peaked in 2006 only to begin a steady decline until 2011. Increased foreclosure rates in 2006-2007 by homeowners contributed to the 2008 market crash. From 2000-2006, overall construction grew 33 percent; from 2006 to 2011, negative growth of 73 percent occurred. However, between 2011 and 2015, the market slowly recovered and experienced 40 percent growth (U.S. Census Bureau, 2015). The real estate bubble directly affected the building industry. When the recession deepened, high performance building helped builders differentiate themselves and attract more cautious buyers in the lagging housing market. Despite the fact that the housing surplus gave buyers an advantage in the market, they showed a willingness to pay more for energy efficient homes (Swanson, 2014). A study done by McGraw Hill Construction showed that builders with energy-efficient and green construction experience remained in business during the recession at
higher rates than their counterparts did (Swanson, 2014). This bolstered the green building industry as the larger market for home efficiency grew. Related products and services spread and prices went down. At the same time, the additional cost of energy efficient home building also decreased (Swanson, 2014).

When the real estate market fought through its downturn, the home performance industry had found its niche. In particular, new, residential homes were increasingly being built to "green" standard. This new share of the market presented opportunities for many involved in the industry, including builders, contractors, distributors, suppliers, and others. The global green building sector continues doubling about every three years (Jones & Laquidara, 2016). In 2013, green homes made up 23 percent of the overall residential construction market (Swanson, 2014). McGraw-Hill Construction expects green homes to comprise 29 to 38 percent of the new-home market by 2017 (2015). Because the movement has become mainstream as a response to the recession, the motivations for building green are diverse. But the underlying outcome remains the same—“improving energy efficiency to reduce greenhouse gas emissions and carbon footprint while realizing economic savings from decreased utility costs over the life of a product and conserving our non-renewable energy resources” (NCREC, 2013). Today, the top drivers for green building include consumer preferences, the widespread availability of green products, cheaper green products, changing code requirements, increased premiums for green homes, and an evolving regulatory landscape (Dodge Data & Analytics, 2016).
While new homes represent an important market, a large proportion of the 130 million homes in U.S. were built before the turn of the century and the mainstream emergence of green building (U.S. Census Bureau, 2016). These homes represent the greatest opportunities for energy-focused remodeling and renovation. Throughout the U.S., houses built from 2000 to 2009 represent 16 percent of all homes. Of the current housing stock, each decade from 1950 to 2010 accounts for at least ten percent of the total housing stock. Houses built before 1950 account for eleven percent of the housing stock whereas houses built before 1920 account for only three percent (Miller, 2014). As shown in Figure 3 the North Carolina housing stock trend line tends to follow the national one, but North Carolina homes built between 2000 and 2009 represent 23 percent of the total state housing stock (compared to 16 percent). Of all U.S. regions, the South is the fastest growing for new home construction, representing nearly half of all new homes (Figure 10 in Appendix A). A substantial majority of homes in North Carolina were built before
the growing emergence of green building. Therefore, older, existing homes represent the area of
greatest potential for home energy retrofits and associated benefits.

On a national level, the capital necessary to undergo home energy retrofits and similar
investments is available through a number of sources including home equity, loans, government
grants, and other financing vehicles. According to the Joint Center for Housing Studies of
Harvard University, home improvements and repair in the U.S. represents a $300 billion industry
making up nearly 2 percent of all U.S. economic activity (2015). Directing home improvement
and remodeling funds specifically toward energy efficiency renovations will drastically benefit
home and building performance on both a state and national level.

From Builder to Buyer: The Process.

Buying a home is usually the single largest purchase a person or a couple will make
during their lifetime. Because of this, homebuilding represents a significant player in shaping the
country’s economy and contributing to its gross domestic product (GDP). Although it fluctuates,
residential investment through homebuilding or remodeling generally represents roughly 5
percent of GDP (Barnes, 2015). The primary purpose of the homebuilding industry is the
construction of new homes, primarily single-family homes. Industry members also remodel of
houses and other residential buildings. Builders within the industry include general contractors,
design-and-build companies, and “single-family construction management firms acting as
general contractors and builders” (Barnes, 2015). Many companies work within specific building
categories or niches (i.e. custom homes or starter homes). The industry is highly fragmented with
both large building firms as well as thousands of small, privately financed builders operating at
the regional level.
A number of stakeholders are involved in the new home building and retrofit process (Table 1), and some of these include regulatory bodies. Regulatory authorities operate within the state of North Carolina that affect the building industry. These include the Building Code Council, the Environmental Management Commission, the Department of Environment and Natural Resources, the U.S. Environmental Protection Agency (EPA), and the U.S. Occupational Safety and Health Administration (OSHA). The North Carolina State Building Code is a set of regulations governing the design, construction, alteration, and maintenance of homes and buildings. It specifies the minimum requirements needed to safeguard health, safety, and welfare of home or building occupants. The Building Code Council consists of 17 members appointed by the governor and works to maintain and enforce the state’s building code (NCDOI, 2017). The Environmental Management Commission consists of 15 members appointed by the governor, the Senate Pro Tempore and the Speaker of the House. The Commission adopts rules for the protection, preservation and enhancement of the state's air and water resources (NCDEQ, 2017). They work in concert with the Department of Environment and Natural Resources and the EPA to uphold environmental regulation. Together, they affect the building industry by specifying regulations pertaining to where buildings and homes as well as their interaction with natural spaces and waterways, and more. Finally, building companies are subject to residential construction OSHA standards aimed at preventing workplace injuries and fatalities.

Table 1: Stakeholders involved in home retrofit process.

<table>
<thead>
<tr>
<th>Home Retrofit Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Homeowner</td>
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<tr>
<td>• Energy rater/auditor</td>
</tr>
<tr>
<td>• Retrofit contractor</td>
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<tr>
<td>• Homebuilder</td>
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<tr>
<td>• Lender</td>
</tr>
<tr>
<td>• Appraiser</td>
</tr>
<tr>
<td>• Suppliers</td>
</tr>
<tr>
<td>• Utility provider</td>
</tr>
<tr>
<td>• Government agencies</td>
</tr>
<tr>
<td>• Real estate agents</td>
</tr>
<tr>
<td>• Affiliated nonprofits</td>
</tr>
<tr>
<td>• NCBPA</td>
</tr>
<tr>
<td>• USGBC</td>
</tr>
<tr>
<td>• Efficiency First</td>
</tr>
<tr>
<td>• NCSEA</td>
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</table>
Due to the high costs associated with building or remodeling a home, securing capital is an essential step in the process. When looking to purchase a home, the homebuyer secures a mortgage from a lender. The two basic categories are the fixed-rate mortgage (which allows for predictable payments) and the adjustable-rate mortgage (which offers lower, more affordable payments, at least at first). Before approving a mortgage loan, the lender takes a number of steps in its underwriting process assessing the viability of providing a mortgage to a homebuyer based on assumed risk. Some of these include underwriting verification, appraisal, title search and title insurance, flood certification, and a survey. The verification process checks to makes sure the borrower is qualified—the greater the perceived risk, the more extensive the verification process. The property appraisal attempts to capture the home’s current market value. This involves a physical inspection of the house by a licensed appraiser and a look at comparable properties recently sold in the area. The title search and title insurance process takes a hard look at the property’s history to look for obstacles such as claims or liens against the property. The flood certification verifies if the property is within a noted flood zone or not. Finally, lenders verify a home’s property boundaries through a professional survey (Bankrate, 2015).

**North Carolina Building Performance Association.**

As North Carolina’s leading association for the expansion of home energy efficiency, the North Carolina Building Performance Association (NCBPA) seeks to promote further growth by educating homeowners, builders, lenders, real estate agents and appraisers on the benefits of green homes and the steps that can be taken to ensure that homes are valuable, healthy, durable, and resource efficient. As a not-for-profit 501(c)(6) trade association, NCBPA works with architects skilled at designing green homes and buildings, professionals proficient in diagnosing energy and performance issues, builders and developers that construct these high performance
homes and buildings, product manufacturers and suppliers that provide the materials needed, and
many others.

NCBPA works with other like-minded state, regional, and national organizations to
advance the causes of the building industry. It maintains membership with Efficiency First, a
national nonprofit organization that serves to advance energy efficient construction through
political advocacy and lobbying. It partners with the North Carolina Sustainable Energy
Association (www.energync.org), a 501(c)(3) nonprofit membership organization of individuals,
businesses, government and nonprofits working toward a sustainable energy future in the state. It
also partners with the Western North Carolina Green Building Council (www.wncgbc.org), a
nonprofit focused on educating and transforming the building industry in the western region of
North Carolina, to advocate for green building and affordable, energy efficiency retrofits. On a
national level, NCBPA works with the U.S. DOE Better Buildings Residential Network, the
Building Performance Institute, and other energy efficiency organizations to help advocate for
energy efficiency programs and promote best practices.

As of spring 2017, the association employs three full-time and two part-time staff, and is
governed by a volunteer Board of Directors. Its stakeholders include over 330 member
companies and several industry partners throughout the region. Its many members include:
architects, associations and nonprofits, builders and developers, building performance
contractors, colleges and universities, crawlspace contractors, energy auditors and engineers,
HVAC contractors, home inspectors, raters, performance contractors, and automation system
service providers, insulation contractors, pest management service providers, product providers,
real estate professionals, renewable energy contractors, training providers, water efficiency and
plumbing contractors, utility companies, and more. It works to reach out to new members to
participate in the benefits offered by the association: insight into new and changing market trends and industry research; recent policy and legislative updates; frequent training and certification seminars for workforce and career development; referrals and lead generation; networking opportunities; and more.

North Carolina’s Building Industry.

North Carolina is the nation’s fifteenth largest state and its ninth most populated with over 10 million people (U.S. Census Bureau, 2017). North Carolina’s building performance industry is among the nation’s best, generating more than $7 billion in annual revenue, including more than 1,250 companies, and employing more than 15,000 workers. For new residential construction in North Carolina, in 2015, over 53,000 total permits were filed, of which over 37,000 were single-family and roughly 16,000 were multi-family (NCBPA, 2016). The state is also a leader in third party verification for energy efficient and high performance homes, showing significant annual growth in certifications in recent years. Since 2007, North Carolinians built or certified nearly 181,000 energy efficient homes and high performance buildings (NCBPA, 2016). From 2010 to 2014 alone, the number of energy efficient homes and buildings in the state increased by 255 percent. According to the North Carolina Sustainable Energy Association, energy efficiency improvements led the clean energy industry in both employment and revenues, representing nearly half of all clean energy jobs and generating more than $2.5 billion in 2016 (Sherman, 2017). The state’s green construction industry is expected to grow and is estimated to support 461,000 total jobs and contribute $39.26 billion to the state’s GDP from 2015 through 2018 (USGBC, 2014).

Participation in third party certification and verification programs represents a measurable way to assess how a state values home energy efficiency. There are a number of new
home certification programs designed to verify specific homes and buildings as energy efficient, but some of the more popular standards are the U.S. Department of Energy’s (USDOE) ENERGY STAR™ program, the USGBC LEED standard, and the Residential Energy Services Network’s (RESNET) Home Energy Rating Standard (HERS score). For all North Carolina homes studied since 2007, the four most popular third party certification programs in the state by overall participation include ENERGY STAR™, HERS Rating, the National Green Building Standard’s (NGBS) green building certification, and Southern Energy Management’s ecoSelect residential green building program (NCBPA, 2016). Although these are the most popular, in our review, we found nearly forty third-party verification programs operating throughout the state (Table 6 in Appendix A). In terms of retrofits, two noteworthy certification programs are Home Performance with ENERGY STAR™ and the Home Energy Score.

In 2015, North Carolina ranked third among U.S. states in the number of new home ENERGY STAR™ certifications, third in HERS Scores, third in NGBS certifications, and seventh in LEED certifications (NCBPA, 2016). For ENERGY STAR™ market penetration, North Carolina ranked seventh with 15 percent compared to the national market penetration of ten percent (EPA, 2016). In the same year, RESNET program ranked North Carolina third with 12,757 homes and an average score of 67 (2016). The USGBC ranked North Carolina as the seventh highest LEED-certifying state in 2013. As the industry grows, these numbers will likely continue to improve. The state is home to over fifty HERS Rating companies that employ around 200 HERS Raters with additional Rating Field Inspectors on staff. HERS Raters cover the vast majority of the state and support energy code compliance in an estimated 90 percent of the state’s municipalities (NCBPA, 2017). As shown in Figure 4, North Carolina progressively built and certified an increasing number of high performing homes and buildings since 2007
(NCBPA, 2016). While a substantial and commendable increase, the potential for greater growth remains, especially for existing residential structures.

**Methods**

The purpose of this project is to aid NCBPA in achieving the difficult task of generating increased consumer demand for energy efficiency renovations in North Carolina’s existing homes. Our objectives are to identify the barriers to the accomplishment of this task, assess their significance within the state, distill those whose removal will produce the greatest returns, and propose ways to eliminate or reduce prominent barriers to provide for the expansion of home energy efficiency and building performance across North Carolina. The end state of the project is the development of a set of recommendations to NCBPA aimed at promoting energy efficiency investments on the part of the owners of existing homes.

In order for our recommendations to be realistic and effective, we account for the current conditions of the housing industry in North Carolina and the capabilities of NCBPA to advocate for and facilitate improved home building performance and energy efficiency. As stated, the

![Figure 4: Home energy efficiency and building performance certification on the rise in North Carolina (2007-2015). Data Source: Inventory data dependent on respondent participation, estimate of trend. NCBPA, 2016.](image)
project focuses strictly upon that portion of North Carolina’s housing market comprised of existing structures. The justifications for limiting the scope of the project to existing homes stem from both client directives on the part of NCBPA and out of the necessity to produce the most impactful recommendations for the North Carolina market as a whole. The advent of green building construction in the United States resulted in the majority of newly constructed homes being significantly more energy efficient than their predecessors, often allowing them to achieve a variety of certifications. The same trend characterizes the housing market in North Carolina. Coupled with the fact that new homes make up a significantly smaller segment of the housing stock in the state, this reveals the importance of targeting existing home renovations to expand energy efficiency across the board. Given that NCBPA is an association of building and home energy efficiency stakeholders, it works daily with the organizations and individuals that possess the expertise to promote and carry out beneficial home renovations.

Despite observing the opportunities for growth in the sector and business for member builders, realtors, appraisers and lenders, the demand for such measures from the existing home side of the industry remains problematic. The recent emphasis on energy efficiency in North Carolina, and around the country as a whole, shows that current conditions support a need for home performance retrofits. Yet, the generation of organic demand for such services by the owners of existing homes is noticeably lacking. This is the direct result of the presence of a long list of barriers that interfere with the diffusion of energy efficiency retrofits and hamper the willingness to pay of consumers statewide. Our results and discussion sections identify a plethora of barriers and elaborate on those most significant to the existing homes market in North Carolina. They include, but are certainly not limited to, a lack of consumer awareness regarding energy efficiency benefits, limited renovation-financing options, incorrectly assessed home
valuation, and improperly implemented marketing plans. Addressing these obstacles and successfully encouraging more owners of existing homes to invest in energy efficiency measures will undoubtedly produce the most lasting and significant change to the market in North Carolina. As a result, it is the sole focus of our analysis and recommendations.

Our project’s methodology consists of comprehensive literature review, structured by a set of resource relevance criteria and guidance from NCBPA. An initial evaluation of the incentives for investing in home energy efficiency, as well as the associated barriers to homeowner commitment, reveals it to be a widely studied and scrutinized topic. As such, an abundance of literature on improving the diffusion of home energy efficiency currently exists. A thorough review allowed us to conduct an exhaustive search for relevant literature, a subsequent assessment of the quality and applicability of those sources, and an extraction of the pertinent data or information from which to conduct an analysis and formulate our specific recommendations. As part of our exhaustive literature review, we established relevance criteria to aid in the standardization of subjective judgments of source usefulness. Those criteria and how they were applied to our sources to determine overall relevance to the project are outlined in Table 2.
**Table 2: Literature Review Relevance Criteria.**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Highly Relevant</th>
<th>Moderately Relevant</th>
<th>Minimally Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publication date</strong></td>
<td>2010 to current</td>
<td>2000 to 2010</td>
<td>Prior to 2000</td>
</tr>
<tr>
<td><strong>Type of publication</strong></td>
<td>Scholarly publications: peer-reviewed literature, empirical studies, literature reviews, etc.</td>
<td>Gray literature: dissertations, market research and technical reports, working papers etc.</td>
<td>Non-scholarly periodicals, news sources and advocacy/opinion-based sources</td>
</tr>
<tr>
<td><strong>Frequency of citation in other works</strong></td>
<td>Frequently cited by scholarly publications</td>
<td>Infrequently cited or multiple citations with non-scholarly sources</td>
<td>Uncited</td>
</tr>
<tr>
<td><strong>Reference to existing homes</strong></td>
<td>Solely existing homes</td>
<td>Existing and new homes</td>
<td>Non-residential buildings</td>
</tr>
<tr>
<td><strong>Reference to North Carolina</strong></td>
<td>North Carolina and southeast US specific</td>
<td>National or non-southeast region focus</td>
<td>International scope</td>
</tr>
</tbody>
</table>

While the overall goal of the project was to provide NCBPA with recommendations to improve rates of homeowner investment in energy efficiency retrofits, our method of using a comprehensive literature review was also designed to produce several important intermediate deliverables. First, we emphasized the development a literature review table. This table (Table 1 in Appendix B) represents a byproduct of our source collection and relevance assessment efforts. It serves not only as a comprehensive list of the literature that supports the project’s recommendations, but also as a consolidated reference of useful sources for further exploration into the subject of promoting energy efficiency growth in existing homes. Thus, while essential to the project’s organization and our analysis, we believe that producing a literature review table as an intermediate deliverable will greatly enhance future study efforts. Prior to developing our recommendations, we focused our literature review efforts on identifying the barriers to investment in the state and analyzing their impacts to establish a prioritized list to enable targeted efforts at barrier reduction. Thus, the identification and prioritization of the barriers present in
North Carolina through an extensive review of available literature makes up our second intermediate deliverable.

The barrier prioritization and the literature review table were distilled through several steps (Table 3). First, we conducted a broad internet search for any literature pertaining to home energy efficiency.

*Table 3: Literature Search Topics.*

<table>
<thead>
<tr>
<th>Literature Search Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>General qualities of energy efficient homes</td>
</tr>
<tr>
<td>Current conditions of the North Carolina housing market and home valuation determinants</td>
</tr>
<tr>
<td>Renovations measures that make homes and buildings more efficient (and the magnitudes of their effectiveness)</td>
</tr>
<tr>
<td>Qualities of successful EE programs and trends in the US and elsewhere</td>
</tr>
<tr>
<td>Benefits achieved through energy efficiency renovations</td>
</tr>
<tr>
<td>Homeowner justifications for and against retrofits</td>
</tr>
<tr>
<td>Factors most often cited as barriers to consumer investment in EE retrofits</td>
</tr>
<tr>
<td>Strategies for reducing those barriers and expanding home EE</td>
</tr>
</tbody>
</table>

Second, we used the results of the initial search to produce comprehensive records of the benefits of and barriers to home energy efficiency, while recording the frequency with which they appeared in the literature. Third, we applied our relevance criteria to the sources. This, in conjunction with the frequency of barrier appearance, allowed us to narrow the scope of the project to a focus on a few prominent barriers. Finally, we discussed these initial results during monthly meetings with NCBPA to receive guidance on the obstacles to emphasize and to determine if the findings were pertinent to North Carolina based on their experiences and work to date. The development of the intermediate deliverables, and ultimately our recommendations to NCBPA, is largely the result of the literature review process. They are supported, however, by the collection of expert testimony from several associates and sources, and a review of the
information presented on NCBPA’s consumer education website.

**NCBPA Home and Building Inventory.**

Over the summer of 2016, NCBPA completed its second annual industry survey of the state’s energy efficient, green, and high performance homes and buildings (NCBPA, 2016). The inventory aimed at providing a better understanding of the quantity of units in the state, capturing areas of high and low energy efficient home and building saturation, and increasing engagement from industry stakeholders and association members. The 2016 inventory acted as a follow-up to the one performed in 2015 by the University of North Carolina-Charlotte’s Energy Production and Infrastructure Center (EPIC, 2015). The inventory incorporates raw data collected from local, state, and national energy efficiency performance certification and verification programs, builders, developers, home energy raters, and others to add to the 2015 database of units built or retrofitted throughout the state since 2007. The 2016 inventory added over 55,000 new data points to the existing database. Because it is in its second year and not all parties participated in the inventory process, there are concerns over the inventory’s complete validity. Reliability also becomes a concern because address-level data proved difficult or impossible to receive from all sources, so duplicates may exist in the database. Because of this, the inventory acts more as an estimate and trend-indicator, ultimately justifying the need for increased availability and transparency of data to support industry growth.

**Results**

Through a systematic review of available literature and anecdotal evidence from informational interviews and testimonials we unearthed a number of active roadblocks preventing existing homeowners from pursuing home energy efficiency upgrades in North
Carolina. A majority of those barriers are displayed in Table 4. This list provides a glimpse of the many obstacles faced by the proponents of home energy efficiency expansion in the state. At the guidance of NCBPA and in our attempts to identify the barriers whose reduction would be most permanent and impactful, our project focuses upon four main areas. Most of the barriers identified in the table below represent an aspect of these larger areas and crossover between them is common. The four main barriers are: holes in consumer education, suppressed home valuation, financial hurdles, and improperly aligned marketing strategies. After providing a brief overview of the four primary barriers, we take an in depth look at their characteristics, impacts on the market, and measures to mitigate their influence on the owners of existing homes. A comprehensive literature review aimed at uncovering this information will ultimately form the basis of a series of recommendations to NCBPA.
Table 4: Commons barriers to home energy retrofits in North Carolina.

<table>
<thead>
<tr>
<th>Common Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long payback period for initial investment</td>
</tr>
<tr>
<td>High upfront cost to homeowner</td>
</tr>
<tr>
<td>Non-standardized energy efficiency certifications</td>
</tr>
<tr>
<td>Lack of a green workforce</td>
</tr>
<tr>
<td>Lack of collaboration amongst promoters (NGOs, nonprofits, HBAs, etc.)</td>
</tr>
<tr>
<td>Lack of communication along real estate transaction (appraisers, real estate agents, lenders, builders, underwriters)</td>
</tr>
<tr>
<td>Value of green home not reflected in the sales process</td>
</tr>
<tr>
<td>Invisibility of energy efficiency features</td>
</tr>
<tr>
<td>Delayed return on investment for homeowners</td>
</tr>
<tr>
<td>Discrepancy between what is effective and what is pursued (i.e. solar panels before attic insulation)</td>
</tr>
<tr>
<td>PACE financing not available in North Carolina</td>
</tr>
<tr>
<td>On-bill financing not available in North Carolina</td>
</tr>
<tr>
<td>Political disagreement regarding financial incentive programs</td>
</tr>
<tr>
<td>Subjective inspection process</td>
</tr>
<tr>
<td>Energy code inspectors not well-trained to recognize home efficiency</td>
</tr>
<tr>
<td>Aging workforce of home and energy code inspectors</td>
</tr>
<tr>
<td>Variable consumer preferences making it difficult to target</td>
</tr>
<tr>
<td>Presence of conflicting studies</td>
</tr>
<tr>
<td>Lack of consumer information regarding home energy retrofits</td>
</tr>
<tr>
<td>General misunderstanding or lack of knowledge regarding personal energy use</td>
</tr>
<tr>
<td>Consumer misconceptions about cost of home energy upgrades (i.e. installing windows, which is very expensive versus insulating attic, which is much cheaper but more effective)</td>
</tr>
<tr>
<td>Time horizons of policies</td>
</tr>
<tr>
<td>Home energy performance not required at time of purchase</td>
</tr>
<tr>
<td>No required inspection for existing homes except at time of purchase</td>
</tr>
<tr>
<td>Greenwashing in third-party certification</td>
</tr>
<tr>
<td>Ineffective marketing or non-existent marketing strategies</td>
</tr>
<tr>
<td>Inability to account for demographics when marketing</td>
</tr>
<tr>
<td>Lack of sufficient data (regional/state specific numbers, certifications, real estate transactions)</td>
</tr>
<tr>
<td>MLSs not showing green or energy related features</td>
</tr>
<tr>
<td>No North Carolina database of energy efficient existing or new homes</td>
</tr>
<tr>
<td>Improper identification of target audience which fails to account for different segment preferences</td>
</tr>
</tbody>
</table>
Barrier Areas.

1. **Holes in Consumer Education.** The consumer education barrier is multifaceted. To make progress addressing the home energy issue requires two things from homeowners: an awareness that changes can be made, and the willingness to make such changes. To begin with, most U.S. consumers are disconnected from their individual energy; existing homeowners are similarly disconnected from the energy use of their homes. Coupled with this disconnect is a fundamental unawareness of what changes can be made to improve home energy efficiency and building performance. In addition, there is a degree of disillusionment regarding what upgrades are most effective and a tendency to invest in more appealing upgrades (i.e. installing solar panels before insulating the attic). Beyond education, consumers need to be engaged and care about their personal and home energy use. As with vehicles and energy use, when energy costs are a low percentage of household spending, people engage and care less about changing their behavior.

2. **Suppressed Home Valuation.** Despite the energy-saving and performance-enhancing features of a well-built home, the home resale process often fails to properly account for these assets. A more accurate reflection of home energy efficiency features in the home resale processes would give homeowners more confidence these types of investments would be reimbursed at time of sale. On a number of levels, from local to national, progress has been made to better reflect these energy-focused investments in the real estate process from home certifications to movement in “greening” the Multiple Listing Service, yet key information and transactional gaps remain (Better Buildings, 2015).
3. *Financial Hurdles.* Home improvements cost money, and energy efficiency upgrades are no exception. Homeowners are faced with a number of financial hurdles including overcoming the high upfront cost and long payback period associated with energy investments. The payback period is the length of time required for an investment to recover its cost through either profits or savings. For home energy improvements, this payback comes in the form of savings. Because most retrofits or home performance upgrades can be quite costly, the payback period is often 15-20 years depending on the project. The longer the payback period, the lower the rate of return, and the more inherently risky the investment.

4. *Improperly Aligned Marketing Strategies.* An effective marketing plan generates customer interest in products or services. It accomplishes three primary objectives: it captures the attention of a target audience; it facilitates a consumer’s decision-making process by providing the information necessary to convince them that investment in a product or service is the best decision to make; and, it enables consumers to commit to their investment choices by providing actions that are specific, low risk and easy to take (Marsig, 2016). While there is clearly a need for expanding home energy efficiency in the United States, generating organic demand for the associated products and services has proven difficult. This is partially due to insufficient marketing practices or strategies that fail to deliver the correct content to the correct consumer. A marketing plan that properly identifies the target audience and accounts for the home energy efficiency attributes valued most by different segments of that audience will go far to accomplish marketing objectives.
Discussion

Barrier Area 1: Holes in Consumer Education

Although energy efficient technologies and home performance retrofits offer considerable promise in reducing both financial costs and negative environmental impacts, homeowners often demonstrate reluctance in adopting these new measures. On the surface, studies show that homeowners declare an apparent preference for energy efficiency (Banfi et al., 2005; Bruegge et al. 2015; Demand Institute, 2013). Why then do they hesitate to adopt new home technologies or make performance upgrades to their homes? This disinclination is often referred to as the “energy paradox” or the “energy efficiency gap” (Gerarden et al., 2015). A paradox exists because the technologies or upgrades—which would lead to an overall benefit—are not adopted. The gap represents the overall economic loss accrued as the optimal level of efficiency fails to occur (Jaffe & Stavins, 1994). These issues arise partly because homeowners lack information regarding specific ways in which they can improve efficiency and reduce overall energy use; the result is a failure to make behavioral improvements, perform energy retrofits, or transition to high efficiency products or appliances. A number of other issues cloud consumer judgement including lack of knowledge of effective energy improvement incentives, an overwhelming number of energy certification labels in the market, and a lack of recognition for trade professional certifications.

Poor Understanding of Home Performance.

Consumers understand that using less power lowers their energy bill, but remain disconnected regarding how their behavior translates into energy use. Perhaps even more
fundamentally, there is a general unawareness of how individual actions translate into energy use, let alone what factors influence home performance. Also, consumers are confused about what makes a home “green”. A 2008 study by Shelton Group, a Tennessee advertising agency, shed lights on this by gauging consumers’ green affinity. When asked to choose what made a home green from a list of 17 possible features, consumers checked an average 10.4 features. The most popular “required” features included ENERGY STAR™ appliances (82 percent of respondents), water conserving features (78 percent), high efficiency windows (71 percent), and finally, renewable electric power such as solar power (71 percent) (Shelton Group, 2008). The results of the study show that consumers see green homes as all-or-nothing propositions. Second, they seem to overlook the more effective yet less popular home energy improvements such as attic and crawlspace insulation or upgraded lighting or HVAC systems in favor of the ‘granite countertop’ versions of energy upgrades: solar panels and snazzy appliances.

**Are Education Campaigns Saying the Wrong Things?**

When asked which single action they can take to conserve energy, the most common responses people give include easier, less effective behaviors such as “turning off lights”. However, when asked what “single most effective action that Americans can do to conserve more energy”, people then tend to list more difficult, more effective behaviors such as insulating their homes or taking public transportation (Attari, et al., 2016). This suggests that people view their own personal behavior in a different sense than that of Americans in general. When more emphasis is placed on the group, consumers are more likely to engage in harder, yet more effective, conservation efforts (Attari, et al., 2016). This also alludes to the need to dedicate educational campaigns toward more effective changes such as home energy retrofits and away
from less effective changes such as turning off the lights. Finally, this shows the importance of making more difficult conservation behaviors seem simpler in order to be adopted—this can be done in a number of ways.

**Nudging and Consumer Education.**

In their well-known book on the topic, *Nudge: Improving Decisions about Health, Wealth, and Happiness*, Thaler and Sunstein (2009) define a nudge as “any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives” (p. 6). Neither coercive nor manipulative, an effective nudge is transparent and built into a basic practice to steer people in a direction without mandating a specific decision.

i. **Information Labels and Disclosure.** Most major household appliances sold in the United States include an energy label to help consumers understand estimated annual energy use and the associated environmental and fiscal costs. Many times, consumers opt for the product that has the most reasonable price *up front*. By providing information about *long-term* savings, energy labels attempt to overcome this common behavior. In this way, they act as a nudge. Newell and Siikamäki (2014) used choice experiments and randomized information treatments to determine the role energy efficiency labeling plays in guiding household energy use. The researchers found that without proper information, or with imperfect information, energy efficiency is significantly undervalued. When using information labels, the information gap begins to be addressed. They found the most important factor in determining whether a more energy efficient appliance is purchased is information regarding the economic value (potential savings) of purchasing the product.
Other types of information (environmental impact or total energy use) played a small but largely insignificant role when compared to economic savings. The role of information labels represents an important use of behavioral economics to encourage energy-saving behavior.

ii. **Nudging and Home Energy Labels.** The use of energy labels for houses and buildings acts in the same way as those for appliances—as a means to increase the transparency of energy consumption in the real estate sector. An increase in transparency will enable homeowners to make more informed decisions regarding home decisions, from consumption behavior to the decision to perform a retrofit.

iii. **Default Options.** People tend to “go with the flow” and do not usually question pre-set options—defaults. A default is a condition that is imposed when there is no active decision to be made by the individual (Johnson and Goldstein, 2003). The often-heralded example of this is automatic enrollment for pension plans. Individuals are much more likely to enroll in a pension plan when they begin their job if it is automatic (with the opportunity to opt out) (Madrian and Shea, 2001). Johnson and Goldstein (2003) demonstrated how having an opt-out policy for organ donation (donor unless actively registers not to be one) results in many more people being organ donors when compared to countries with opt-in policies. Consent rates can even vary dramatically—Austria’s opt-out policy results in 99 percent organ donors, whereas Germany’s opt-in policy only results in 12 percent organ donors. Sunstein and Thaler (2003) showed that when consumers are unaware or unfamiliar with a product, they are more susceptible to stick with the default settings. Pichert and Katsikopoulos (2008) showed that people are more likely to choose electricity from “green” sources (versus grey-sourced) when it is
presented as the default option rather than the alternative. This is pertinent to the discussion on home energy use, as most consumers know little about the intangible commodity of electricity. When consumers are considering intangible commodities, they tend to stick with the default setting. Some of the reasons for this include a degree of inconvenience and uncertainty associated with switching providers. There may also be a lack of information or skepticism about the non-default option.

iv. **Social Comparison.** One popular nudge used in behavioral economics is the use of social norm comparison. People generally have a conditional preference to follow social norms and “adjust their behavior according to the behavior of others and their presumed reasons for acting as they do” (Thaler and Sunstein, 2009). For example, Goldstein, Cialdini, Griskevicius, and Deighton (2008) used two field experiments to examine the effectiveness of hotel guest’s participation in an environmental conservation program in a hotel. As any hotel guest knows, towels are replaced daily during a stay unless otherwise indicated. Increasingly, hotel chains are encouraging their guests to reuse their towels during their stay in order to conserve energy and limit the environmental impacts from detergents. In the majority of cases, the hotel places a simple card in the bathroom with a written appeal to how reusing their towel can help protect the environment. For the first experiment, researchers used two signs. The first sign reflected the standard “save the environment” approach, the second conveyed the environmental message along with a descriptive social norm by informing guests that the majority of guests reuse their towels at least once during their stay. Guests staying a minimum of two nights were studied over an 80-day span with 1,058 instances of potential towel reuse in 190 rooms. “Reuse” took place when at least one towel was reused (participants could indicate the desire to reuse
their towel by placing it back on the towel rack; if they did not want to participate, they would leave their towels on the floor). The second message, which employed the use of descriptive social norm, resulted in a 44 percent participation increase over the standard environmental message. The second experiment worked in tangent with the first by exploring the overall influence the reference group used has in the effectiveness of the descriptive norm. Studying different reference groups--gender identity, guest identity, citizen identity, and room identity--revealed little difference. The bottom line: people respond to social comparisons, and, in this case, a small change in context--a nudge--resulted in a better environmental decision. Similar research looks at how these social comparisons can affect home energy use.

A short review of the power of nudges works to explain how people do not necessarily make decisions on a rational basis and are influenced by other factors. Addressing home energy use through subtle changes in message can lead to high-reward, low-cost results.

**OPower Uses Social Norm Comparison to Change Behavior.**

OPower’s behavior-focused campaign offers an effective way to cost-effectively influence change on a large scale ([www.OPower.com](http://www.OPower.com)). Recently purchased by Oracle, OPower is a Virginia-based software company that forms partnerships with energy utility providers in order to improve energy efficiency. The company developed an energy report tailored to individual homeowners. The regularly mailed reports leverage social norm comparison to produce change in energy behavior. Each report contains two principal features. First, an Action Steps Module that gives the homeowner household-specific information about energy use and tailored strategies for conservation. The generated suggestions take into account fleshed out
patterns revealed by energy use over time and certain demographic trends. If, for example, a household used significantly more energy in the summer, a possible suggestion would involve installing better insulation. Second, the reports offer a Social Comparison Module that compares the household’s energy use to that of its one-hundred closest neighbors in houses of similar size (Figure 5). Allcott (2010, 2011) analyzed the effects OPower’s energy conservation program had on household energy use. Of the nearly 80,000 households studied, only half received the Home Energy Reports described above. Allcott found that these homes used 2 percent less electricity than those that did not. The impacts were strongest for homes with the highest baseline consumption, which make intuitive sense. This 2 percent change is equivalent to a short-run electricity price increase of 11 to 20 percent (a short-run price differs from long run in that it takes into account variable costs and reflects market disruptions such as changes in commodity prices). Further experiments in other areas of the U.S. produced similar results demonstrating that besides the benefits of energy conservation, this simple nudge results in an annual savings of $300 million. Similar studies on the effectiveness of OPower’s social comparison nudge show similar decreases in home energy use (Ayres, et al. 2009, Pellerano, et al. 2016). Furthermore, Allcott and Rogers (2014) showed that, although some initial behavior decay took place initially, household energy conservation habits improved over time as consumers became accustomed to

![Figure 5: OPower's home energy reports: Social Comparison Module. Source: Allcott, 2011, OPower.com.](image-url)
Goal Substitution.

A study by the UK’s Department of Energy and Climate Change looked into how reducing the “hassle factor” of making energy-efficiency upgrades would affect consumer behavior (2011). To do this, the researchers looked at what it would take to get consumers more interested in insulating their attics. One significant barrier to the task included the disruption caused by cleaning out an attic for the work to be done. Will minimizing the hassle result in more attic insulation projects? The answer is yes. When a company offered to clear out the attic, store items (or donate unwanted ones), and return the rest after insulating the attic, households demonstrated a threefold increase in participation (DECC, 2011). Substituting the goal of using less energy (by insulating the attic) with another goal (cleaning out the attic) results in increased consumer participation in home energy upgrades (The Economist, 2012).

High Quantity of Certification and Verification Programs.

The NCBPA annual market survey identified 36 unique third party verification and home certification programs available and active in the state pertaining to home performance, energy efficiency, and/or other aspects of green building characteristics (Table 6 in Appendix A). While it is good that such programs exist, the high number of certifications acts to counteract their overall purpose by weakening their overall market value. It also makes it difficult for homeowners and others in the marketplace to distinguish among the differing benefits, costs, participation requirements, and other comparative measures.
Barrier Area 2: Suppressed Market Valuation

Two factors affect the market valuation of homes: the home appraisal and the sales price. The market valuation process is suppressed in North Carolina because the often invisible energy-saving and performance-enhancing features of a well-built home are often overlooked or inadequately reflected in both these processes (NCBPA, 2016). Energy efficient homes represent environmental responsibility by cutting water and energy use, providing cleaner living spaces, saving homeowners money, reducing greenhouse gas emissions, and more. Along with cutting down on utility costs, energy-saving features such as effective insulation or tight ducts come with other benefits including good indoor air quality and a comfortable home. Well-designed airflow results in less dust, less drafts, and fewer issues with pests. The resulting improvement in air quality allows for healthier residents as well as less maintenance costs. Other common features of an energy efficient or high performing home include water conservation products and practices, materials reuse, waste diversion, sustainable and natural landscaping, and environmental low impact development. According to NCEAA, certified, new energy efficient homes perform 20-30 percent more efficient than standard homes which results in annual savings of $300-500 (2017).

Energy Efficiency Valuation.

Despite the fact that the home valuation process can overlook high performance home features, proponents of home energy efficiency often cite housing value premiums as one of the key selling points in homeowner decisions to commit to retrofits. In 2015, the Danish Energy Agency commissioned a study to examine the relationship between housing prices and energy efficiency standards. Part of the study focused on achieving a better understanding the role that
energy labels and certifications play in determining a consumer’s willingness to pay, and consequently, the market price of the home. The goal was to “disassemble” a customer’s valuation of a house into individual elements, or in other words, to prioritize the attributes presented to consumers in the energy efficiency renovation decision-making process (Hansen, et al., 2015). The study presented respondents with ability to choose between houses with various combinations of four attributes: house size, lot size, condition of the structure, and six incremental energy labels. In addition to finding that energy certifications are a primary factor affecting purchasing decisions, the results showed that on average, consumers are willing to trade fifteen square meters of floor space for each increase in energy efficiency label. Perhaps more importantly, the researchers were able to conclude that for each incremental jump in efficiency label quality, the odds of a given consumer choosing a particular home increased drastically. In some cases, those odds increased by as much as 65 to 94 percent (Hansen, et al., 2015). Homeowners in this study clearly valued energy efficiency certifications, and assuming similar patterns of attribute preferences exist in the United States, the applications to the development of effective marketing and advertising plans are extensive. Often, however, the effectiveness of certifications and labels is diminished by an overabundance of possibilities, a lack of understanding of their differences, and poorly presented information. Overcoming the obstacle requires simplifying certifications and the presentation of information that eases consumer comprehension.

In recent years, these energy-saving and performance-enhancing features have begun to be reflected in the housing market as a whole (new and existing homes). For example, NCEEA found that certified ENERGY STAR™ New Homes in Raleigh-Durham-Chapel Hill spent 89 less days on the market and sold for a premium $5,566 higher than similar code built homes.
without EE innovation (2011). In a large-scale study of 1.6 million California homes sold
between 2007 and 2012, Kok and Kahn investigated the price implication of three "green" labels:
LEED for Homes, ENERGY STAR™, and GreenPoint Rated (2012). They found a premium
price increase of 9 percent for certified homes. They also noticed the price was influenced by
climate—the premium was higher in hotter climates where cooling is more important. They also
found a correlation with political ideology and willingness to pay—areas showing more
environmental consciousness (as measured by hybrid vehicle registrations--"the Prius Effect")
also showed a higher willingness to pay for green features (Kok & Kahn, 2012). These
corroborate similar findings shown in Table 5 illustrating an increased premium of 4 to 14
percent and up to 42 fewer days on the market for certified homes. Similar studies conducted in
Europe, where the use of home efficiency labels is more prevalent, houses sell for a premium 10
percent higher than homes without such a label.

Table 5: Energy efficiency and high performance homes reflected in the marketplace.

<table>
<thead>
<tr>
<th>Premium Price Increase</th>
<th>Fewer Days on the Market</th>
<th>Location</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5,566</td>
<td>89</td>
<td>Raleigh-Durham-Chapel Hill, NC</td>
<td>NCEEA, 2011</td>
</tr>
<tr>
<td>$4,576</td>
<td>24</td>
<td>Chicago, IL</td>
<td>Elevate Energy, 2014</td>
</tr>
<tr>
<td>13%</td>
<td>42</td>
<td>Raleigh-Durham-Chapel Hill, NC</td>
<td>Argeris, 2010</td>
</tr>
<tr>
<td>14%</td>
<td>N/A</td>
<td>Asheville, NC</td>
<td>Mosrie, 2011</td>
</tr>
<tr>
<td>10%</td>
<td>0</td>
<td>Seattle, WA</td>
<td>Griffin et al., 2009</td>
</tr>
<tr>
<td>9%</td>
<td>N/A</td>
<td>California</td>
<td>Kok &amp; Kahn, 2012</td>
</tr>
<tr>
<td>4%</td>
<td>31</td>
<td>Atlanta, GA</td>
<td>Griffin, 2009</td>
</tr>
<tr>
<td>4%</td>
<td>18</td>
<td>Portland, OR</td>
<td>Griffin, 2009</td>
</tr>
<tr>
<td>3%</td>
<td>N/A</td>
<td>Washington, D.C.</td>
<td>Institute for Market Transformation, 2015</td>
</tr>
</tbody>
</table>
However, these studies reflect statistics for new homes or housing stock that includes both new and existing homes. This makes it difficult to see what effect energy efficiency improvements or performance certifications have on existing homes. However, overall, for both new and existing homes, high performing, energy efficient homes are both undervalued and misunderstood in the marketplace. This is due to a number of reasons including a lack of comparable home data, an insufficient suite of Multiple Listing Services, and a disconnect of both understanding and communication in the real estate community, and others.

**Driving Change through Underwriting.**

The underwriting process can be adapted to better account for home assets achieved through high performance, energy saving features. To make these adjustments does not require a fundamental change in traditional underwriting or valuation practices; but it does require a broader understanding and fresh analysis as to what brings a home value. Before a home is sold, a property appraisal takes place to estimate the home’s market value. This is part of the process that often overlooks home energy efficiency features. The current underwriting process can often view these features as “risks” because they vary from the market norm; this ends up penalizing the owner’s investments in efficiencies. Part of this is because appraisers are unaware or uncertain of the value added by efficiency features. The process needs to shift to properly reflect how a high performance home actually reduces the risk of the investment and allows for greater cash flow through savings. An example of a program that highlights green features to document increased cash flow and value and reduced expenses is the Green Building Underwriting Standards, which assess properties on a scale of 1-100 on green assets during the underwriting process (Winters, 2008).
Value Proposition across Sectors.

Retrofitting homes to realize greater performance and efficiency can act to benefit involved parties throughout the real estate process (Figure 6). Besides the benefits of increased comfort and livability for homeowners, they save money on electric and utility bills. Real estate agents selling energy efficient, high performing existing homes will be able to highlight these features in a responsive market; this results in premium pricing and faster sales. For lenders, money saved by the potential homeowner means earlier mortgage payoff and a reduced the risk of default. Appraisers with a recognition of how energy efficiency results in increased home value will be in high demand for services. The underwriting process will reflect energy efficiency and high building performance reported by the appraiser, resulting in a fair home value at closing.

Figure 6: The high performance home value chain. Adapted from: CNT, 2013.

Lack of Comparable Home and Building Data.

Without concrete data collection and ongoing analysis, the above changes to the home valuation process cannot take place. NCBPA emphasizes their first-hand experience with this problem: “Training real estate agents and appraisers on energy efficient features, advertising the “greenness” of a new building with certificates or labels in the building lobby and other steps that have been undertaken for years in North Carolina have amounted to very little meaningful improvement in the market due to a lack of comparable data in the real estate and appraisal...
process for these homes and buildings.” (2017). To properly drive change through the underwriting process requires evidence of realized (not just perceived) increased value from high performance homes. To do this requires an ability to compare sales prices and appraised values of high performing in comparison to others. A thorough statewide database with features showing address-level information on third-party certifications and other key indicators is a necessary start to the process. Allowing these features to be searchable during the initial phase of the home buying process is a related area for change.

“Greening” the Multiple Listing Service.

A multiple listing service (MLS) is an essential system used in the real estate business. Acting as an extensive database of home listings, it allows licensed real estate agents and brokers to list homes along with prices, neighborhoods, and features. Over 850 independent MLSs operate throughout the U.S. providing property information to inform lenders, sellers, buyers, and real estate agents about home values. Realtors and other involved parties pay to utilize the system and agree to share their listings. Since licensed realtors sell 92 percent of U.S. homes, the MLS plays a key role in the large majority of real estate transactions (NAR, 2016). Given its features and the necessary role it plays for real estate agents, brokers, and other involved parties, the MLS represents a probable catalyst for change in the housing market. A “green” MLS provides standard property information as well as additional data fields highlighting green features, energy efficiency certifications, and more. This creates a more comprehensive platform for home valuation by enabling interested homebuyers to search for high performing homes, and sellers and builders to market their green homes.
Progress has been made in including green features in the MLS. A 2010 survey by the National Association of Realtors found that nearly a quarter of the MLSs in the U.S. allowed for search capabilities for green features (Efficiency First, 2010). Progress corresponds to the rise in green building: Elevate Energy found that of the 100 MLSs in the top U.S. population centers, 85 allowed for searchable green features (Shutters, 2014). Although there is progress in including green features within MLSs throughout the country, consistency of how features are listed, how values are justified, and how these characteristics are understood within the market seems to vary. According to NAR, a well-functioning green MLS “reflects a set of fields that will be easily used and hard to misuse by either traditional agents or appraisers” (2012). Such standardization limits the ability to greenwash by empowering the buyer and seller to define and set a value on energy efficient, high-performance features. In North Carolina, there are over 60 Real Estate Associations and 46 independent MLS territories using five different software programs. According to the North Carolina Energy Efficiency Alliance, of the MLSs, only five have a green feature search-ability (and the degree of “greenness” varies) (2013).

In 2008, the FMLS, an Atlanta-based MLS, incorporated a number of third party certifications and searchable items. The decision to transition toward a more comprehensive search-ability involved pointed effort among a few real estate agents, the FMLS board of directors, and the Greater Atlanta Home Builders Association. The process of deciding on searchable features and working through details took less than a month. After finalizing the specifics, changes were implemented when the software for FMLS underwent its next major update. Finally, the green feature search-ability function was presented at the FMLS yearly trade show; members were educated at the trade show and through email communication. Part of the education for FMLS realtors, intended to help avoid greenwashing, included how to properly
represent and understand green features. The searchable certifications included EarthCraft House, ENERGY STAR™, NAHB Green, and LEED for Homes. Searchable items included geothermal HVAC, low-flow toilets, ENERGY STAR™ appliances, tankless water heating, solar water heating, and solar photovoltaic. The FMLS hopes to include more features and certification levels when awareness and understanding increases among consumers and real estate agents. The housing market showed consistent growth throughout 2009. More specifically, third-party certified homes sold for premiums closer to the listing price, for a higher price on average, and in a shorter amount of time than the competition. Further statistics showed a rising trend in the proportion of local green home sales (Table 7 in Appendix A).

**Aging Home Inspector Workforce.**

A large portion of the nation's building code officials are within a decade of retirement without a cohort of young professionals to take their place. The International Code Council (ICC) develops model building codes later adopted on the state and local level. They also develop the International Energy Conservation Code (IECC). According to ICC, within the next fifteen years, roughly 80 percent of inspectors plan to retire; 30 percent plan on retiring within five years (Fabris, 2017). Of those surveyed by the ICC, only 15 percent are under 45 years old, and only 3 percent are under 35. Without an equivalent number of young code professionals prepared to take over for those retiring, the industry is facing a tough road ahead. This is made more severe considering that most city code departments are relatively small; a third have one to four members and serve communities less than 75,000 residents (ICC, 2014). The shift in workforce demographics represents a unique opportunity to train new, young professionals to recognize home energy efficiency and performance measures often overlooked in the past.
In order to prepare for having less code officials, the ICC has begun outsourcing energy code inspections to certified RESNET HERS Raters. This provides a number of benefits to the industry by: 1) giving confidence to code jurisdictions that energy code inspections are done by qualified individuals; 2) reducing costs to builders who can have a HERS Rating performed at the same time as an energy code inspection; 3) relieving the burden faced by understaffed coding jurisdictions, and finally, 4) promoting energy efficient homes by effectively tying in energy code inspection with the HERS Rating process. A current partnership between the ICC and RESNET allows current RESNET HERS Raters to undergo certification as ICC Energy Code Inspectors. It also allows membership in the ICC which provides a voice during the code development process (RESNET, 2015).

**Barrier Area 3: Financial Hurdles**

Financial hurdles are one of the most substantial barriers preventing existing homeowners from undergoing retrofits. Homeowners are challenged with finding ways to make energy improvements affordable. Some financial challenges include the high upfront cost and the long payback period associated with home retrofits as well as the struggle to receive proper lending. Some common solutions to overcoming financial hurdles include rebate programs, PACE financing, On-bill financing, and others.

*Long Payback Period.*

The payback period is the length of time required for an investment to recover its cost through either profits or savings. For home energy improvements, this payback comes in the form of savings. Because many commonly thought of retrofits or home performance upgrades can be quite costly, the payback period can be many years depending on the project. However,
for most home energy retrofits, such as air sealing or improved insulation, this is not as much of an issue. In addition to a lack of consumer education and unknown or misrepresented market valuation, the long payback period roadblock is highly problematic for NCBPA. At its core, the long payback period associated with higher-end energy efficiency retrofits presents a financial burden to the homeowner and results in underinvestment in obviously beneficial measures. It is important, however, to consider elements of the long payback period that extend beyond strictly financial factors. Doing so invokes a discussion of human behavior, attribute preferences, and the concept of intertemporal choice. The problems presented by a long payback period readily lend themselves to an examination of intertemporal choice in the decision-making process. An understanding of this concept will enable a deeper comprehension of consumer behavior and impact recommendations for reducing the long payback period obstacle.

Intertemporal Choice.

Intertemporal choice refers to any scenario where a person makes a decision between multiple options whose consequences present themselves at different points in time. This topic has been studied in countless contexts and the overwhelming conclusion is that humans undervalue or discount future outcomes relative to proximal outcomes (Soman, et al., 2005). While the psychological and behavioral factors underpinning this consensus are topics of great debate, the role of intertemporal choice in home energy efficiency decision-making is indisputable. Improving home energy efficiency typically requires significant upfront investment. While the financial benefits over time are well established, homeowners often do not experience the rewards of their decisions to bolster energy efficiency for years or decades down the road. As previously stated, it is the nature of consumers to undervalue anything other
than immediate gains and, therefore, efforts to expand home energy efficiency must address and overcome the formidable challenge of the long payback period.

Intertemporal choice as it pertains to the long payback period is a key contributor to the energy efficiency gap. The energy efficiency gap consists of a slower diffusion (or market penetration) of energy efficient products than would be expected if consumers made positive net present value investments or eliminated the discounting of future benefits (Gillingham and Palmer, 2014). Gillingham and Palmer’s publication, *Bridging the Energy Efficiency Gap: Policy Insights From Economic Theory and Empirical Evidence*, details the tendency of consumers to fail in making energy saving investments that have positive net present values and the predominance of a behavior in which future energy savings are heavily discounted. The authors state that the energy efficiency gap is fed to a degree by behavior anomalies that create systematic biases in intertemporal decisions. In turn, this generates a discrepancy between the benefits a consumer expects at the time of purchase or investment and those that they actually experience in the future due to their earlier decision. Therefore, bridging this gap and promoting energy efficiency penetration in the market by overcoming the long payback period requires an understanding of human behavior throughout the decision-making process.

To address the behavior anomalies associated with the long payback period, Gillingham and Palmer explore potential policy solutions. Sometimes the energy efficiency gap can be fixed by providing more or better information or by changing the consumer’s choice setting. Behavioral failures can also be addressed through policy solutions such as information strategies (energy audits, social norm campaigns and product energy efficiency labeling), financial incentives (such as subsidy programs), and the establishment of energy efficiency standards for homes, vehicles, and other products (Gillingham and Palmer, 2014). The first-best strategy for
overcoming the energy efficiency gap and promoting faster diffusion in the home renovation market may include a combination of information campaigns, financial incentives, and the adoption of energy efficiency standards.

For more expensive retrofit projects, the long payback period represents a frustrating barrier for the industry because there is significant evidence that it should not be a consideration in homeowner decision-making altogether. In 2005, a choice-experiment attempted to quantify the first willingness to pay estimates in both existing and new housing sectors. After performing an econometric analysis of the stated preference data, the authors discovered a significant willingness to pay for energy efficient attributes in their homes or rental properties. In fact, the willingness to pay for these attributes was generally higher than the actual costs of implementing the renovations. The results of this study show not only that retrofits are desired and economically feasible, but also that the long payback period may be of overstated significance. Nonetheless, homeowners often cite high upfront costs and long payback as primary factors for choosing not to invest in energy efficiency. This difference between what homeowner’s cite as obstacles to investment and their stated preferences, such as a high willingness to pay, highlight the importance of attacking barriers like the long payback period through both financial and behavioral solutions. For example, in the study mentioned above, the authors conclude that the observed underinvestment is due to legal and socio-economic barriers, as well as a lack of information regarding efficiency measure advantages and the inability to express the advantages in sound economic terms (Banfi, et al., 2005).

*High Upfront Cost.*

High upfront cost is the initial expense needed for a homeowner to invest in an energy
efficiency retrofit and represents one of the main barriers preventing homeowners from making home improvements. This is especially the case for low-income families. Unfortunately, low-income families lacking the money for home improvements tend to live in the most energy inefficient homes—homes that are ideal for retrofitting. Low-income families pay proportionally more for energy bills. The energy burden for low-income families in Charlotte ranges from 5 to 15 percent of household income where the average family experiences a burden of 3.5 percent (Drehobl and Ross, 2016). In order to remove this barrier and increase energy efficiency, many energy finance programs have appeared in recent year that provide loans and funding for homeowners or commercial buildings to install energy efficiency retrofits. Those programs vary in loan structures and lender institutions. This diversification, although it makes programs fit better with local legislation and financial environment, could also bring hurdles for some states that want to follow a pilot energy efficiency program. Among those financial programs, On-bill Financing and PACE Financing are the most popular ones.

**PACE Financing.**

Property Assessed Clean Energy (PACE) programs allow home and building owners to pay upfront costs of clean energy over time as an addition to their property tax bill. Common improvements allowed under the residential PACE program include installing more efficient air conditioning systems, better insulation, and solar panels. The public entity enables the financing, and the building owner sees the value of the improvement added as a lien against their property that they can pay off over time. PACE loan terms vary but are commonly 15 to 20 years with interest rates typically slightly above market rates for mortgage. The lien remains with the property even if it is sold (IBE, 2013). Because many homeowners move every 5 to 7 years, the
The transferable nature of a PACE loan allows for property owners to recoup their investment upon sale (NREL, 2010). Energy improvements result in immediate savings (lower heating and cooling bills) for the homeowner. Residential PACE improvements in the state of California are responsible with saving 9.1 billion kWh of home energy, eliminating 2.5 million ton of greenhouse gas emissions, and allowing over 100,000 property owners to save money on their energy bills (Salas, 2016). Because clean energy and increased efficiency benefit both private and public entities, there is a certain logic met by the shared responsibility presented by PACE financing options. PACE Financing works to address roadblocks to energy efficiency growth at the residential level by addressing lack of homeowner capital and reducing risk to making long-term energy investments.

**North Carolina PACE Program.**

PACE-enabling legislation was passed in 33 states and Washington, D.C., and the PACE program is active in 19 states and Washington, D.C. (U.S. Department of Energy, 2016). Although North Carolina passed PACE-enabling legislation, there is currently no program operating. The North Carolina General Assembly passed Senate Bill 97 which enacted PACE legislation in the fall of 2009. The law allowed local governments to place assessments on properties to pay for “distributed generation renewable energy sources or energy efficiency improvements that are permanently fixed to residential, commercial, industrial or other real property” (NC Gen. Assembly, 2009). Municipalities and counties choosing to participate in the program could finance them through revenue bonds, state general revenues, or obligation bonds. NCBPA advocated for the removal of the sunset that would have ended PACE financing in 2015.
Senate Bill 284, passed in 2015, extended the legislation allowing local governments to adopt PACE programs through June 30, 2020 (U.S. Department of Energy, 2015).

The delay in activating a state PACE program is not unusual. Virginia lawmakers passed legislation in 2009 allowing PACE programs; in February 2017, Arlington County finally overcame critical hurdles and introduced plans to launch its commercial PACE program in the summer of 2017 (Pierobon, 2017). Now other interested local governments, energy contractors, possible capital investors, and Southeastern states are monitoring Arlington County’s clean energy development. Part of this interest lies with the hope that once commercial PACE financing is implemented in the state, approval of residential PACE financing will shortly follow. Arlington County’s Community Energy Coordinator, Richard Dooley, believes roadblocks to PACE program adoption in the Southeast U.S. are largely due to a deficiency of advocates, open-minded lawmakers, and private sector support. He adds that PACE programs also “find themselves at odds with bankers wary of the mortgages they grant having to compete with another lien in the event of a default” (Pierobon, 2017). Rosenfeld mirrors this thinking, adding that the barriers to PACE in North Carolina include three policy roadblocks: 1) lack of local government understanding of PACE, 2) lack of delegation to central authority to complete administrative and finance tasks, and 3) the additional need for state-level approval for local debt (2015). NCBPA is working to coordinate efforts to address some of these policy gaps to get commercial PACE financing off the ground in North Carolina.

**On-bill Financing.**

On-bill Financing (OBF) is a financial mechanism that provides homeowners or building owners with financing to make retrofits and upgrades to increase energy efficiency. And the loan
is paid back through regular monthly utility bills. Currently OBF is provided for residential, commercial and industrial sectors. OBF has its own advantages compared with other energy efficiency programs. Firstly, OBF is cost-effectiveness. Several OBF programs require energy savings every month being greater than or equal to loan payments, which means even with loan payment, homeowner or building owner's monthly utility bill can only decrease or stay the same but not increase. This requirement makes OBF a useful way to save energy with no extra financial burdens for homeowners, which is especially helpful for low income families. Secondly, an OBF loan has a lower risk compared with other loans in energy efficiency financial models. Because utilities can secure the loans by stopping their services as soon as a failure of monthly payment, investors regard OBF as riskless assets. The actual average program default rate is 3 percent (NCSL, 2015). Thirdly, OBF is a good way to keep track of energy savings through meter and utilities' monthly bills which most energy efficiency programs cannot. Most energy efficiency financing programs do not publish their savings data potentially due to the difficulty of collecting data and the complexity of calculating savings. The data collected by the OBF program is a good resource for future studies and is a useful information for utilities. Fourthly, on-bill tariff programs are like PACE financing programs that could link the payment to the property but not the homeowner, which resolves the problem for renters and homeowners who will move to new places soon. Currently there are 12 states that have legislation in support of OBF. Another 20 states have utilities implementing or developing OBF programs, including North Carolina. NC currently has OBF related policies, and OBF is available but not required in NC. Some North Carolina cooperatives, such as Roanoke Electric Cooperative and Brunswick Electric Membership Corp have provided OBF services for their customers. However, development of OBF is not in scale because of coops and customers' unfamiliarity with this
program. In 2015, The North Carolina On-Bill Working Group was set up by Appalachian Voices, the Environmental Defense Fund, the Southern Environmental Law Center, the Southern Alliance for Clean Energy, the Environmental Finance Center at UNC-Chapel Hill and the Southeast Energy Efficiency Alliance, in order to provide education, resources, and technical assistance for electric coops and stakeholders to expand OBF programs and help save energy in NC.
Case Study: Sonoma County Energy Independence Program.

The Sonoma County Energy Independence Program (SCEIP) was designed in 2009 by the California county’s Energy and Sustainability Division. Being the first county-wide PACE financing program that includes residential services, Sonoma County Energy Independence Program provides both residential and commercial PACE financing for energy efficiency, water conservation, and solar energy improvements to existing homes and business properties via a special voluntary property tax assessment. The SCEIP program aims to change homeowners’ and building owners’ attitudes toward home and building energy usage, and encourage the installation of renewable energy, energy efficiency retrofits, and water conservation project within Sonoma County. SCEIP targeted homeowners through educational outreach programs “to broaden consumer knowledge in conservation, efficiency and generation” (SCEIP, 2011). This increased consumer awareness, and encouraged homeowners to adopt the SCEIP program. SCEIP also provided specific training to raining to local contractors which helped create additional energy-efficiency related jobs in the county.
"Barrier Area 4: Improperly Aligned Marketing Strategies"

The final key barrier to homeowner investment in energy efficiency upgrades in North Carolina revolves around an inadequate or misaligned marketing strategy. A successful marketing strategy encourages consumers to invest in a product or service by correctly identifying the target audience and analyzing their preferences and behaviors. It is comprised of a comprehensive messaging plan and a manner of positioning that makes investment by the target audience most appealing. A marketing strategy absent of these components will fail to put the best information regarding energy efficiency attributes in front of the consumers that would likely pay for their implementation, thus inhibiting the further development of the industry. While energy efficiency in North Carolina is trending in a positive direction, the potential for much greater improvement remains. Despite the abundant and well-documented benefits that come from decisions to upgrade homes for energy efficiency, homeowners are subjected to a plethora of barriers to investment. A robust marketing strategy that accounts for the various segments of the target population, as well as their respective attitudes and preferences, can play a role in reducing most of these barriers. The following sections describe the fundamentals of a conjoint marketing strategy and what the available literature tells us about homeowner preferences in the energy efficiency market.

"Conjoint Marketing."

A conjoint marketing strategy uses information regarding human behavior to sell a product or service. More specifically, it is based on an analysis of how individuals assign value to the various attributes of a product or service with the ultimate objective of identifying those attributes that are most influential in the decision-making process. The practice of conjoint
measurement is especially useful in market research because it provides the ability to quantify elements of consumer judgement. (Green and Rao, 1971). By incorporating the data obtained through choice-based experiments and other forms of behavior analyses, one can achieve a deeper understanding of consumer preferences, thereby laying the foundation for an effective conjoint marketing plan. As our literature review revealed, behavioral factors play a large role in determining the likelihood of an owner’s decision to invest in the energy efficiency of their home. In 2011, for example, a study by Energy and Environmental Economics, Inc. which focused on behavior-based energy efficiency concluded that consumer energy choices are influenced by behavioral and social factors as much as, if not more than, economic factors. It prioritized consumer concepts of risk and uncertainty, a lack of information, and personal customs and habits as the leading causes of homeowner energy efficiency education gaps (Mahone and Haley, 2011). Conclusions of this nature are why a conjoint marketing strategy can be effective in promoting energy efficiency renovations in existing homes.

**Utility of Conjoint Analyses in Understanding Energy Efficiency Decision-Making.**

The literature supporting the application of conjoint marketing to energy efficiency programs is extensive. Conjoint analyses of consumer preferences and attitudes are valuable because they can assist in the development of a conjoint marketing plan to expand home energy efficiency programs. Torok and Cavalli’s article, *Analyzing Consumer Behavior for Setting Energy Efficiency Program Priorities* shows how conjoint analyses can be effective tools for developing market transformation programs. Specifically, these analyses can be applied to the creation of knowledge-based programs that serve to promote the benefits of energy efficient technologies to residential consumers (Torok and Cavalli, 2000). Conjoint analyses are critical
to energy efficiency marketing plans because they aid in the identification of the renovation attributes most heavily valued by a consumer and therefore serve as good predictors of their choices and behaviors. According to Torok and Cavalli, conjoint analyses can also serve as assets for market penetration forecasting because it allows us to progress from predicting relative to absolute consumer behavior (Torok and Cavalli, 2000).

Two conjoint analysis applications have been particularly useful for market penetration forecasting. The first approach involves the combination of information about equipment choice with demographic data that predicts aggregate purchase volume. The second successful approach uses a “conjoint style experiment” to determine attribute points where consumers are repelled from a market, or conversely, swayed into early investment or adoption (Torok and Cavalli, 2000). The study illustrates these approaches through an analysis of why and when certain homeowners decide to upgrade to energy efficiency lighting and HVAC systems. Not only does the article highlight the applicability of these approaches to successful marketing schemes, but it also underscores the importance of conjoint analyses in home energy efficiency program expansion.

Conjoint analyses are valuable tools for accurately understanding consumer behavior, a critical capability for those who seek to change or otherwise enhance that behavior. They also provide for the identification of barriers and a quantification of their relative importance, effective messaging strategies, and the determination cost effective efficiency technologies to target with educational market transformation campaigns (Torok and Cavalli, 2000). As Torok and Cavalli reveal, conjoint analyses provide the energy efficiency market with a means of
examining hypothetical product or program attributes and their valuations and should be an
integral component to future planning on the part of home energy efficiency professionals.

*Conjoint Studies of Drivers and Barriers.*

Energy efficiency drivers and barriers fall into a wide array of categories, and although
understanding the factors in totality is vital to expanding the home renovation market, the
behavioral influences are likely the most relevant when considering a more effective marketing
campaign. In 2007, Martin Jakob published an article discussing several approaches he used to
determine the reasons for low rates of homeowner investment in energy efficiency despite clear
advantages of committing to such renovations. One method utilized a conjoint approach to model
renovation decisions based on revealed discrete choice data. The model is based on technical,
socio-economic and behavioral hypotheses and it tests for commonly stated homeowner
assumptions regarding the barriers to and drivers of energy efficiency retrofit investments
(Jakob, 2007).

In his study, Jakob identified a multitude of behaviorally associated drivers and barriers,
and developed a series of conclusions regarding consumer attribute preferences. Jakob’s
conclusions are as follows:

i. In his survey of homeowners, Jakob found that 63 percent valued “high level
   building quality” in their homes the most and only 33 percent gave priority to
   maintaining building value in the long run.
ii. Jakob explored the specific triggers for investing in energy efficiency measures.
    He found homeowner motivations are split approximately evenly between
    environmental or energy saving considerations and aesthetic justifications.
iii. The majority of homeowners that improved insulation cited environmental and
    energy saving justifications as relevant. On the other hand, those that invested in
major structure overhauls, such as window and roof repair and replacement, did not refer to this argument at all.

iv. Consumer age stratification is an important consideration. Middle-aged owners tend to emphasize building quality while retired persons favor low maintenance costs. Furthermore, young homeowners (less than 45) base their decision-making on consultations with industry experts while those in older age brackets base their decisions on their own determinations or from word-of-mouth.

v. A lack of information also plays a large role. Jakob found that homeowners rarely request more information but readily do so when prompted about additional incentives believed to be useful from their subjective points of view.

vi. The impact of financial incentives to renovations may be overstated. When presented with a variety of energy efficient renovation attributes, those involving favorable cost-effectiveness or fiscal incentives were minimally valued. The three most frequently chosen justifications were “environmental and energy-saving considerations, building extensions and/or alterations, and increasing comfort of living.” (Jakob, 2007)

**Consumer Preferences for Energy Efficiency Measures.**

In 2002, an article published in the *Journal of Economic Psychology* examined household preferences for energy efficiency measures and their determinants. The study used an additive part-worth function conjoint analysis to examine preferences for twenty-three different energy-saving measures. The conjoint analysis of consumer attribute preferences showed that the energy-saving strategy was the most important aspect of the decision-making process and led to the greatest acceptability of energy efficiency measures. Specifically, technical measures to increase efficiency, such as installing energy-efficient heating systems and refrigerators or improving home insulation, were far more acceptable than measures aimed at reducing indirect energy use (i.e. shifting consumption). Justifications for this outcome include a lack of
understanding on how shifts in consumption or changes in products save energy and the idea that consumers are generally unaware of indirect energy use to begin with (Poortinga, et al., 2002).

The study also resulted in several other conclusions about homeowner attribute preferences and choices, the acceptability of energy-saving measures, and marketing considerations for improving efficiency diffusion. First, the magnitude of conceivable energy-savings was a relatively insignificant factor. In other words, attributes outside of the effectiveness of a particular measure in saving energy are more highly valued by most consumers. Furthermore, economic and socio-demographic status does not preclude certain groups from investing in energy efficiency measures. It does, however, dictate the type of measures that are most acceptable among different groups or within a given area (Poortinga, et al., 2002).

The Role of Demographics.

While Poortinga’s article touched upon the importance of demographics in marketing home energy efficiency, several later studies examined the subject deeper. These studies reveal the characterization of the targeted population to be far more important in determining the acceptability of and investment in energy-saving measures than initially stated by Poortinga. One study concluded that in regards to household energy behavior, there are distinct family-age cohort patterns. Families with young children are more likely to adopt energy efficient technologies and use energy-saving practices in their homes. Conversely, older households were determined to have less knowledge with respect to energy use and attributed minimal importance to using energy efficiency to reduce environmental impacts (Mills and Schleich, 2012). As a result, the authors advise that the gains from marketing energy efficiency to older homeowners
will be minimal but, if incorporated in the overall plan, should be based solely on financial incentives. Research results also showed a great deal of heterogeneity in energy conservation practices, household attitudes toward savings, and technology adoption across an education level stratification. In general, low education households were reluctant to invest in energy efficiency measures. Mills and Schleich state that this stems largely from profitability information constraints and could be alleviated through targeted advertising campaigns, such as at application points for social assistance programs (Mills and Schleich, 2012).

In 2015, a conjoint study by Ameli and Brandt produced similar findings. Based on a survey of homeowners in France, this study focused on the determinants of household investment in energy efficiency. It found that rates of investment, consumer behavior and attribute preferences are based largely on home ownership, income, social context and household energy consumption practices. In general, renters experience weak efficiency investment incentives and therefore value low-cost, mobile attributes, such as high-performing appliances and light bulbs. Like Mills and Schleich, Ameli and Brandt concluded that investment is substantially less among low income and low education households, often due to credit constraints (Ameli and Brandt, 2015).

**Consumer Attitudes and Perceptions of Profitability.**

A 2011 conjoint analysis of the attitudes and preferences of homeowners regarding home energy efficiency improvement measures presented respondents with a list of objectives (attributes) typical of home energy efficiency refurbishment justifications. The study reinforced some of the previously discussed findings on the marginalized impact of financial profitability. While they assess financial profitability as an important factor in dictating investment, the
subjects of this survey prioritized other elements, most notably comfort, convenience, status and belonging (Zundel and Stieb, 2011). Furthermore, the authors state that the profitability aspect is incorrectly marketed toward consumers due to a fundamental difference in economic understanding between homeowners and economists. The economic motivation of many homeowners appears to be less of a calculation involving a short payback period and considerable net present value and more of a goal to invest against future economic uncertainty (Zundel and Stieb, 2011). In light of this discrepancy, many homeowners underestimate the energy-savings potential of their homes and efficiency investments are consequently minimal. Information and professional energy advice can help to remedy the situation, but only if such consultation is not limited to economic profitability in expert terms (Zundel and Stieb, 2011).

**Eco-labeling and Operating Cost Disclosure.**

In 2012, a paper titled *Consumer Response to Energy Labels: Insights from Choice Experiments* was published to review four choice-based conjoint studies. It highlighted the emerging importance of energy eco-labeling and operating cost disclosure in consumer home, vehicle and appliance investments. The premise of the article is that empirical data on how operating costs and labels impact consumer behavior and on the most effective way to display specific energy efficiency information is limited. The authors’ review of the conjoint studies provided for several conclusions. First, evidence showed that the format in which energy consumption information is presented significantly influences consumer choices, especially in regards to how they value future benefits relative to the purchase price (Heinzle, 2012). Additionally, the study found that disclosing lifetime energy operating cost information was the most effective means of using eco-labels to guide consumers toward energy efficient shopping
behavior (Heinzle, 2012). In another study, Heinzle found that consumers are more likely to invest in homes and products with high ratings on simple, straightforward certification schemes. In this case, rates of consumer investment were significantly greater with products certified on a simple A through G scale than when the certification scheme was muddled with additional A+, A++ and A+++ classifications. With more complicated classifications, consumers were typically unable to differentiate between classifications and often concluded that attaining these standards was not worth the extra cost (Heinzle, 2012). The findings of the study reveal strong business opportunities for green building developers, areas for improving marketing and advertising efforts, and means of promoting the diffusion of energy efficiency in the housing market.

Lessons Learned from Energy Efficient Appliances.

In consideration of the housing market, parallels drawn from studies of common household appliances provide important lessons learned. A 2010 study by David Ward examined how to U.S. energy labeling programs, ENERGY STAR™ and Green Power Partnership, influenced consumer willingness to pay for refrigerators. The study implemented a conjoint analysis choice experiment designed to replicate the purchase decisions consumers contend with in the market (Ward, 2010). The study concluded that willingness to pay was greatly influenced by energy labels. With ENERGY STAR™ certified refrigerators, for example, consumers were willing to pay a premium of $255.10 to $313.51 and were motivated by energy costs savings and environmental friendliness benefits (Ward, 2010). The study also showed that consumer demographics and attitudes were significant factors in dictating investment. Female consumers, those with greater levels of stated concern for the environment, and individuals with strong perceptions on their ability to affect product design and ambient
environment exhibited greater willingness to pay for energy efficient refrigerators (Ward, 2010).

Another study also employed a conjoint analysis to explore how consumers trade-off among different attributes when considering investing in room air conditioners. The researchers focused on five product attributes and found that the most important factor in deciding purchase was price, followed by energy savings, brand, warranty period and quietness of operation (Hock, et al., 2002). Perhaps more importantly, the study concluded that the importance of the attributes varied across different consumer groups. Older respondents favored energy savings while younger groups gave greater value to brand. In addition, those with lower educational levels and incomes focused almost exclusively on price while those in higher brackets preferred to make their choices based on energy saving capability (Hock et al, 2002).

**Recommendations**

**Consumer Education.**

Educating consumers on the energy and non-energy benefits and values of home energy improvements remains a significant barrier hindering retrofits in the existing home market. These barriers exists partly because homeowners lack information regarding specific ways in which they can improve efficiency and reduce overall energy use; the result is a failure to make behavioral changes, perform energy retrofits, or transition to high efficiency products or appliances. A number of other issues cloud consumer judgement including a lack of knowledge of effective energy improvements, an overwhelming number of energy certification labels in the market, and a lack of knowledge about incentive programs. There are many factors influencing this, and there is no simple way of addressing the problem with consumer education. Furthermore, as the literature on nudging suggests repeatedly, human behavior is often illogical
and heavily influenced by outside factors such as economic and social dynamics. In approaching the existing home market, the audience spans a wide range of demographic groups with different education-related barriers; this makes it difficult to present a concise yet inclusive solution for North Carolina. A good start to educating consumers is through maintaining and bolstering current efforts with NCBPA’s [www.HomeEnergyNC.org](http://www.HomeEnergyNC.org) website.

**Recommendation 1: Bolster HomeEnergyNC website and continue working with stakeholders to increase website impact.**

We recommend that NCBPA continue to maintain, bolster, and channel more visitors to its home energy in North Carolina website ([http://homeenergync.org/](http://homeenergync.org/)) by increasing relevant content, creating salient charts and materials, and increasing partnerships with likeminded organizations to increase web-traffic. Currently, the website aims to serve as an “online portal for saving energy at home, providing a centralized, free, and unbiased resource with helpful information and tools to improve home energy efficiency” (NCBPA, 2017). The website is supported by NCBPA, the North Carolina Sustainable Energy Association, the Southern Alliance for Clean Energy, and Duke University’s Carbon Offsets Initiative.

The current website has a number of well-defined and thorough sections dedicated to home energy. One section presents information tailored to six different roles: renters, homeowners, youth & students, senior citizens, property owners, and educators. Another is dedicated to research and publications on a number of home energy efficiency topics. The “Learn About” section offers insights into specific aspects effecting the industry including building code, advice on selling an energy efficient home, and state and federal policies. The “Help Getting Started” section offers information pertinent to financial incentives, ways to
calculate level of home improvement need, a contractor directory, and more. Of note, is the “Building Certification Programs Guide” which gives essential information on the various third-party certification programs, what they cover, and some of their differences. The website content is relatively comprehensive but could be strengthened with more educational resources, more poignant graphics and charts, and downloadable educational aids. It also could use more North Carolina and regionally-specific data and case studies pertinent to local homeowners.

The website acts to address the many voices clamoring for attention in the home energy sector by attempting to condense information and present it to consumers in a tangible, unbiased way. The platform is comprehensive, attractive, and easy to navigate. However, it will not be effective if consumers do not use it. NCBPA needs to actively track website traffic and set realistic goals for growth. NCBPA needs to continue to actively seeking partnership with other organizations, home building associations, and nonprofits. In turn, these groups need to promote the website to their stakeholders. The stakeholder group needs to weigh in on the website content and development process to ensure a level of objectivity. With increased involvement from North Carolina stakeholder groups, we believe the HomeEnergyNC website could become a crucial platform for consumer education, but it increasing traffic and engaging likeminded groups is essential. Part of this will require NCBPA to explore other advertising practices such as radio, TV, social media, and, related to our marketing recommendation, conjoint marketing.

Currently, the Duke Carbon Offsets Initiative is working with us to offer programs whereby corporations, universities, etc. can refer their employees to the site to save money on their energy bills and improve the performance of their homes. This is a innovative category aimed toward consumer attention. NCBPA should continue exploring the possibility of working with utility companies and electric cooperatives to get them to refer their customers to the
website. Instead of managing their own education websites, the utilities can collaborate with NCBPA. Finally, NCBPA should look for opportunities to work with educational institutions such as public and private schools, colleges, universities, and community colleges to establish a partnership and engage the younger generations.

**Market Valuation.**

As discussed throughout, one consistent barrier to homeowners deciding to commit to retrofitting their homes with energy upgrades is the uncertainty surrounding whether or not energy-related investments will be properly reflected in the home valuation process. It is established that high performing, new residential homes with third-party certifications sell for a greater premium and in shorter time than their counterparts (Table 4). What is not established is consistent data on the market valuation of retrofits and energy investments in existing homes. While it is assumed that such improvements would act to increase the value of a home, without comparable home data, it remains an assumption. In discussing the issues surrounding market valuation, we established that to drive change surrounding market valuation involves “greening” the MLS, creating an underwriting process that recognizes energy improvements as risk averse rather than risk prone (money saving rather than money sinks), influencing the home inspection process to allow for energy improvements to become more transparent, and staunching the emergence of additional third-party verification programs while at the same time promoting ones with the greatest potential for the industry. Data is needed about each of these processes; while at the same time, data is likely needed to influence change surrounding these processes. Comparable home data on the resale homes could potentially help substantiate their energy-saving, money-saving value.
Recommendation 1: Create a position within the association dedicated to full time data collection and management.

Since securing a robust dataset along a number of criteria remains pertinent to driving change in the market valuation of high performing existing homes, we recommend NCBPA create a position dedicated to this task. The 2015 inventory project undertaken by the University of North Carolina-Charlotte’s Energy Production and Infrastructure Center and NCBPA was largely a success in its first year. As discussed earlier, the inventory aimed to collect raw data from home energy certification and verification programs, home builders, energy raters, home developers, and others about homes, buildings, and units retrofitted throughout the state since 2007. The 2016 inventory added over 55,000 new data points to the existing database. Because it is in its second year and not all parties participated in the inventory process, there are concerns over the inventory’s complete validity. Reliability remains a concern because address-level data proved difficult or impossible to receive from all sources, so duplicates may exist in the database. Because of this, the inventory acts more as an estimate and trend-indicator, ultimately justifying the need for improved availability and transparency of comparable home data to support industry growth.

For the second inventory, one part-time intern was hired for three months. Of the roughly 400 companies and certification programs the intern requested data from, only about 10 percent chose to participate. This is likely due to a number of reasons including a limited time frame and a lack of incentive for the participating company. Rather than happen once each summer, we believe data collection should be an ongoing process. With a full-time staff member dedicated to data collection and management, the inventory could overcome issues of reliability and validity through more persistent pursuit and collection of data points. Also, the position would actively
seek and apply for funds (in the form of grant monies or similar resources) to create incentives for company participation and to support the overall goal of a robust database. The position would also be responsible for managing all data files and the portion of the NCBPA website housing annual survey results.

Currently, participants typically submit data by email. NCBPA should create more fluid and intuitive data submission process to allow for more seamless submittal on behalf of companies and certification programs. The submission form should be standardized to allow for cleaner data files. Ongoing communication among NCBPA, like minded partner organizations, and member companies needs to be ensured in order to orchestrate an effective, ongoing process. NCBPA should strongly encourage member companies to submit annual data across a number of metrics.

**Recommendation 2: Push for Home Energy Score adoption throughout the state to establish baseline understanding of third-party verification.**

**Third-party Verification Programs.**

There are nearly forty programs currently operating in North Carolina which aim to provide a level of verification pertaining to home energy use, environmental friendliness, green features, home health, or other metrics surrounding energy efficiency and home performance. Many of these programs tend to overlap and cover many of the same features. Some are national and some are strictly regional. While on the surface, such programs act to benefit the green building sector and promote its fundamental principles, an overabundance of programs causes problems for the homeowner, homebuyer, and other interested parties. The homeowner struggles to decide which program certification is best to use. The homebuyer struggles to interpret the findings of one program versus that of a next when comparing homes to buy. For industry
players such as contractors, builders, energy auditors, home inspectors, and others, such an
abundance makes it difficult to stay abreast of what each certification entails, what benefits it
brings, or how it may affect an existing home’s resale value.

Ideally, a standard score would be created that uses an algorithm to condense the values
of scores across all programs weighted based on strength of metrics, and more, to produce one
standard score for homes in North Carolina. More specifically, this score would focus on existing
homes. However, since creating its own score is likely beyond the scope of NCBPA’s current
resources, we recommend the association focus on continuing to create comprehensive materials
about each program and certification. Also, because it is so straightforward and provides a
logical jumping-off point for those unfamiliar with home energy, we recommend NCBPA focus
heavily on promoting the U.S. DOE’s Home Energy Score.

*Home Energy Score.*

Part of the difficulty with third-party certification programs is the time it takes to
complete them along with the understanding needed on behalf of the assessor. In 2010, the U.S.
DOE developed a low-cost, reliable method for homeowners and buyers to understand their
homes’ energy efficiency and home performance. After a number of pilot studies and focus
groups, they launched the Home Energy Score (HES) program in 2012. Over 50,000 homes have
been assessed using the HES since that time (U.S. Department of Energy, 2017). The score itself
is the home equivalent of the miles-per-gallon rating for a vehicle. It uses a simple 1-10 scale (10
being the most efficient) to rate a home on its efficiency. The assessments take less than hour,
the test materials are free for assessors, and the scoring system is simple, credible and
straightforward. It provides homeowners and homebuyers with knowledge regarding home
energy efficiency and cost-effective improvements in order to reduce energy use and costs. Furthermore, it promotes the use of reliable, consistent home energy efficiency information in real estate transactions in order to build the market value for high performing homes. Because of these reasons, the HES represents an ideal scoring system that NCBPA should promote.

Use of the HES has financial incentives as well—under Fannie Mae’s HomeStyle Energy mortgage loan, borrowers are permitted to finance up to 15 percent of a home’s “as completed” appraised value for energy efficiency or home performance improvements by receiving a HES. For scores of 6 or higher, or for making upgrades to less efficient homes, borrowers can qualify for a stretch on their debt-to-income ratios allowing them to have larger debt ratio without accruing penalties. Similarly, the Federal Housing Administration (FHA) has a similar policy that allows larger debt-to-income ratios for high scoring homes. Both of these policy-based incentive programs reflect the fact that more efficient homes have lower operating costs and use the HES as a basis for the prognosis.

The Western North Carolina Green Building Council (WNCGBC) (http://wncgbc.org/), an Asheville-based nonprofit working to promote environmentally friendly building practices, and a strong partner of NCBPA, launched the Green Gauge program in 2016. The program aims to target the existing home market and help existing homeowners discover how to make their homes healthier, more environmentally friendly, and energy efficient. The program was launched in Asheville, NC during the summer of 2016 with financial support from the Z. Smith Reynolds Foundation (http://zsr.org/), a partnership with the U.S. DOE, and marketing, contractor training, and quality assurance support from NCBPA. The program includes a home assessment covering energy use, water use, materials sustainability, indoor air quality, and site assessment. Included with the assessment is a U.S. DOE Home Energy Score. The WNCGBC aims to assess 500
homes each year going forward and continue spreading the program throughout the state (Flannick, 2016).

Green Gauge represents an important step forward for North Carolina third-party certification programs because it connects a national program to a regional program. WNCGBC is already well-known and well-established in western North Carolina and has made significant contributions toward promoting green building. Using their program, which takes into account North Carolina building code and practices, climate factors, and other regional effects, while also promoting the easy-to-understand HES is a commendable strategy. We recommend that NCBPA continue its efforts to promote Green Gauge and help the HES gain traction in North Carolina. NCBPA should also explore the option of working with local utilities to work toward incentivizing the program. For example, Duke Energy provides an incentive program in connection with ENERGY STAR™ appliances. Such a partnership would allow for quicker adoption and a longer time horizon for the HES program.

Recommendation 3: Create a real estate working group to make concerted efforts toward “greening” the MLS.

Home features that indicate high performance, energy saving measures, or other similar metrics need to be featured in MLSs throughout the state in order to bring about change in the home valuation process. As described in the earlier discussion on the MLS, a number of case studies demonstrate how including such features leads to higher premiums for energy efficient homes. For existing homeowners to be encouraged to make energy improvements, it would be helpful for them to know these features will be included in the listing during the resale process.
Without the knowledge that such upgrades will become apparent, included in the appraisal, and relayed to possible buyers, the homeowner remains less motivated to make improvements. On an intuitive level, it is safe to assume it would motivate them to make more obvious upgrades such as new countertops or a Jacuzzi tub knowing these features will be highlighted. Regarding energy upgrades, without proper reflection in the MLS, homeowners may feel consigned to undertaking visually obvious upgrades (like solar panels) over the behind-the-scenes, less glamorous investments (such as attic insulation).

As the phrase goes—“all real estate is local”—and that applies to greening an MLS (NAR, 2012). Regional practices, local homebuilding programs, state and city codes, and local climates should influence the green fields implemented by an MLS. A working group made up of stakeholders involved in all aspects of the homebuilding and home buying process will be able to effectively speak to the fields most likely to be populated in a given region. These stakeholders include builders, remodelers, real estate agents, appraisers, industry advocates, among others. A group with different levels of expertise and knowledge and diverse backgrounds will allow for a comprehensive approach to the planning and implementation process. Setting out, the working group should follow the steps outlined in the NAR’s “Green the MLS Toolkit” or a similar program (NAR, 2012).

NCBPA should continue working with other organizations and their members to develop a working group with the sole purpose of greening North Carolina MLSs. After initial success, we believe two things are critical: 1) NCBPA should collect data is regarding the impact of the new green fields to be used to when approaching other MLSs; and 2) the working group should continue working to green MLSs and train others in the North Carolina homebuilding and environmental sectors to do the same.
**Marketing.**

NCBPA’s consumer website contains much of the information a homeowner may be looking for when considering an investment in the energy efficiency of their property. While not entirely specific to North Carolina, it is simple to navigate and the content presented is easy to understand. It is also highly educational. The website teaches users about the industry in general and elaborates on specific homebuilding performance and energy efficiency measures. It also lists an abundance of contacts (director, staff and member companies) and can guide homeowners to resources local to their area of the state. Perhaps most importantly, the website aptly uses relevant literature and recent studies to document and present the benefits owners will experience if they invest in the energy efficiency of their homes.

While a quality resource for North Carolina’s homeowners, NCBPA’s website is currently the association’s *only* marketing tool in the campaign to expand the energy efficiency of existing homes in the state. Its level of traffic is limited to being the result of a curious homeowner’s internet search, word of mouth between customers, mentioning by member companies, etc. Without other means of directing consumers to the website, its capacity for outreach in the market is limited. This problem can be addressed, however, through the advertising component of a properly aligned marketing strategy. One of the ways to attack the issue is through the use of an external marketing firm. Marketing firms plan and implement a company’s marketing strategy by conducting market research, competitive analyses, budget development, advertising methods, and metric collection. However, the funds to hire a marketing firm or manage a robust marketing strategy internally is not available for NCBPA in
the near term. This does not mean that the marketing barrier to home energy efficiency diffusion should be ignored or that any efforts to address it at this time would be wasteful. To the contrary, the current situation provides NCBPA with the opportunity to incorporate the lessons learned from previously described conjoint analyses to plan for future marketing and advertising strategies that are properly aligned with various segments of the target audience. This effort will greatly enhance the effectiveness of such strategies at a time when their implementation becomes financially feasible. In facilitation of the proactive endeavor, we recommend NCBPA focus on several actions in the near term. First, NCBPA should employ a conjoint marketing approach to future efforts. Second, its marketing strategy should emphasize demographics, thereby enabling advertisements based on economic and social status, education levels, age stratification and regionality. Finally, NCBPA should continue with attempts to simplify energy efficiency certifications and eco-labeling while emphasizing their effectiveness as selling points.

**Recommendation 1: Employ a conjoint marketing approach**

As our literature review showed, homeowners vary tremendously in terms of what drives them toward investments in energy efficiency or repels them from the market altogether. Many of the justifications behind this idea extend far beyond the obvious advantages of home energy efficiency upgrades espoused by the experts in the field. Indeed, human behavior itself plays a significant role. A better understanding of how homeowners value the beneficial attributes of energy efficiency, as well as the joint effects of more than one of these attributes, has the potential to drastically increase the rates of investments in home renovations. It is therefore critical that NCBPA adopt a conjoint marketing strategy to appeal to the maximum number of consumers in the manner that is most attractive to their individual preferences. A marketing
strategy that accounts for consumer behavior and attribute preferences and tailors messages to different demographic groups will be far more successful in encouraging the penetration of energy efficiency upgrades in the home renovation market than one which neglects it solely in favor of economic considerations.

Conjoint marketing provides for the understanding past and present behavior, as well as the potential to forecast the future behavior of home energy efficiency actors. Conjoint analyses of consumer behavior and preferences also give invaluable insight on where home energy efficiency can be expanded, how it can be accomplished, and how much of an impact it can produce. Other benefits of this strategy include the following (Polaris Marketing Research, 2011):

i. The ability to determine the energy efficiency service or product offering with the optimum combination of features according target audience segment
ii. The ability to predict the market shares of alternative product concepts.
iii. The capacity to adjust pricing based on what customers say they are willing to pay for a given feature.
iv. A means of computing the relative value contribution of each attribute within the product or service offering.

Specific ways to advertise energy efficiency attributes, as determined by a conjoint marketing approach focused on variations in consumer preferences, are detailed in the second recommendation.

**Recommendation 2: Emphasize demographics to align marketing efforts to target audience**

Promoting home energy efficiency investments and overcoming barriers requires a robust information campaign and marketing strategies tailored to different consumer views on home
quality and value, financial benefits, maintenance costs, renovation lifespan, aesthetics, noise, comfort and environmental or energy saving potential. The understanding of populace composition and demographics will greatly enhance the ability to put forth and market the most effective and acceptable energy efficiency measures. The results of our literature review show the importance of considering consumer demographics and socio-economic status when developing marketing strategies and implementing policies to address specific barriers. By surveying homeowners based on these factors, the authors of many studies were able to determine the energy efficiency attributes most influential in their respective decision-making processes.

Most of the literature reviewed for this project emphasized the roles of household income, education level, and occupant age as key determinants of home energy efficiency investments. Our review provided two important conclusions regarding these demographic variables. First, regions characterized by high household incomes, high levels of education, and young residents exhibit greater homeowner willingness to pay for energy efficiency. Second, the marketing messaging plan that appeals most to this population is one that touts the energy-saving capabilities and environmentally-friendly benefits of investing in home energy efficiency retrofits. Since cohorts that meet the specifications above are more likely to invest, properly aligning this messaging strategy with its intended audience will be most effective in contributing to the overall goal of expanding energy efficiency in the existing homes of North Carolina. An examination of the demographic indicators of North Carolina’s one hundred counties allows us to recommend priority locations for advertising and marketing as well as the messaging themes in those areas that will results in the highest degree of consumer uptake.
We pulled demographic data from the North Carolina Office of State Budget and Management and the ESRI Data Partner Network to identify the optimal marketing locations in North Carolina by county age stratification, education level, and resident age. The optimal counties according to each demographic indicator are shown in Table 6 and, again, are determined by looking at the counties with the highest household incomes, youngest residents, and greatest frequency of residents with higher education. The indicators are specifically based on state data revealing county median household income, county median age, and the number of bachelor’s degrees by county, respectively. Figures 11, 12, and 13 in Appendix A contain the corresponding heat maps for each variable and show the frequency of counties that fall within those ranges.

\begin{table}[h]
\centering
\caption{Top fifteen North Carolina counties for focused marketing by highest income, youngest populace, and education.}
\begin{tabular}{l l l}
\hline
\textbf{Highest Income} & \textbf{Youngest Populace} & \textbf{Most Educated} \\
\hline
1. Wake County & 1. Onslow County & 1. Wake County \\
2. Camden County & 2. Watauga County & 2. Mecklenburg County \\
3. Mecklenburg County & 3. Pitt County & 3. Guilford County \\
5. Orange County & 5. Cumberland County & 5. Forsyth County \\
8. Iredell County & 8. Orange County & 8. Orange County \\
9. Dare County & 9. Mecklenburg County & 9. Union County \\
11. New Hanover County & 11. Craven County & 11. Pitt County \\
12. Davie County & 12. Wake County & 12. Cabarrus County \\
15. Forsyth County & 15. Guilford County & 15. Gaston County \\
\hline
\end{tabular}
\end{table}
Cross-referencing the lists for each indicator reveals some counties to be state leaders in multiple categories. With this information, we produced a county map of North Carolina showing Priority (state leader in all indicators), Secondary (state leader in two indicators), and Opportunity (state leader in one indicator) locations for home energy efficiency advertising and marketing efforts (Figure 7). As funds for advertising and marketing become available and the circumstances become favorable for NCBPA, we recommend these future efforts follow the progression shown in the map. By emphasizing Priority counties first, followed by Secondary and Opportunity locations, the greatest gains in expanding energy efficiency in the state’s existing homes will be realized. These areas have the populations whose characteristics make them most likely to be attracted to energy efficiency marketing, and therefore, most likely to act on investments in home renovations. Again, the literature shows a messaging plan focused on environmental benefits and energy-saving considerations will be most successful in these counties. Maps by median age, income, and education are located in Appendix A (Figure 11, 12, and 13).

Figure 6: Priority counties by combined metrics of education, age, and income. Source: NCOSMB, 2017.
While demographic variables are important considerations in the diffusion of home energy efficiency and efforts in the areas described above should be given priority, attempts to address the gaps in other parts of the state should not be altogether abandoned. As some of the reviewed literature shows, individuals that do not fall within the ideal demographic spectrum typically exhibit lesser willingness to pay for energy efficiency. These factors, however, don’t preclude them from investing entirely. Often, it simply means they are motivated by different energy efficiency attributes and they are partial to other types of renovations. As a result, audience messaging must be tailored to the preferences of the typical resident of the area in question. Our research shows low income, low education, and older households generally have less knowledge of energy use and place minimal importance on using energy efficiency to reduce environmental impacts. The opportunity to invest for these groups is substantially less and they are generally reluctant to pay for improvements. In most cases, marketing efforts in regions with populaces characterized in such a manner should instead be focused on costs and future financial benefits, with secondary emphasis placed on improved structure performance and increased comfort of living.

A potential criticism of this approach is that our Priority Marketing Map simply identifies the most populous counties of North Carolina and, in many cases, our Priority and Secondary counties are likely home to large transient populations due to the presence of universities. A quick examination shows that this is certainly the case for Mecklenburg County (University of North Carolina - Charlotte), Forsyth County (Wake Forest University), Guilford County (University of North Carolina - Greensboro), Orange County (University of North Carolina-Chapel Hill), Durham County (Duke University and North Carolina Central University), Wake County (North Carolina State University), and New Hanover County (University of North
Carolina - Wilmington). Large percentages of the populations associated with these schools are
assumed to be renters or reside in campus housing. As several of our studies showed, renters
typically lack the motivation to make energy efficient investments. Data from the North
Carolina Office of State Budget and Management, however, reveals that the transient population
concept may be insignificant in consideration of the expansion of home energy efficiency. The
average population growth rate for the counties above from 2010 to 2015 was 8.3 percent with
Mecklenburg, Durham and Wake counties growing by more than 10 percent (NCOSBM, 2017).
Thus, short-term residents, such as impermanent students, are being replaced by significantly
larger numbers of more permanent-party residents or students that opt to stay in the area
following graduation. Coupling the fact that the our Priority and Secondary counties are the
youngest, wealthiest and most highly educated in the state with the knowledge that they also
possess the largest, burgeoning populations reinforces the recommendation to start marketing
and advertising efforts in these locations.

A conjoint marketing approach is the best strategy for generating homeowner interest in
energy efficiency because it provides for the identification of attributes valued most by diverse
groups of consumers. It tells us who is most willing to pay for renovations, what kind of
improvements they prefer, and the message most likely to convince them to commit to investing
in their properties. Our literature review showed evidence of high variability among consumers
and the importance of demographic indicators in properly aligning marketing strategies with the
right target audiences. We recommend NCBPA apply a similar methodology for other
demographic and socio-economic elements in future analyses to bolster the effectiveness of their
marketing campaign. Additionally, the collection of demographic information should be
considered an important aspect in upcoming industry surveys and state inventories. This will
help the association achieve a better understanding of the characteristics of consumers who choose to renovate. Such information will reinforce ongoing successful efforts to promote retrofits, enhance marketing in other likely areas of the state, and help North Carolina capitalize on turning the obvious need for energy efficiency into an organic consumer demand.

**Finance.**

A number of issues effect a homeowner’s decision to undergo energy-related home retrofits. A lot these retrofits do not cost a lot to effect substantial change and positive improvement in home energy use and overall performance. However, for extensive retrofit work or more expensive projects, the upfront cost and payback period posed to the homeowner becomes a sticking point. A number of financial tools are available to address this problem. We have discussed the two we think are most appropriate for NCBPA to promote to help homeowners in North Carolina—PACE financing and on-bill financing.

**Recommendation 1: Promote on-bill financing in North Carolina by joining the North Carolina On-bill Working Group and working to diversify capital funding from the federal government, local electric cooperatives, and credit unions.**

As discussed earlier, the high upfront cost is a main barrier that discourages homeowners from undergoing energy efficiency retrofits. Among energy efficiency financing programs, on-bill financing is quite prevalent and is available in twenty states (NCSL, 2015). The popularity of on-bill programs demonstrates its flexibility and viability in different legal, financial, and market environments. North Carolina not only has related financial policies supporting on-bill programs, but several electric cooperatives, including Roanoke Electric Cooperative and Brunswick Electric Membership Corporation, also have current on-bill repayment programs underway. Since development of on-bill financing is not yet to scale, we
predict that North Carolina could become a large market for on-bill financing and repayment programs in the near future. With favorable conditions for further development of on-bill programs, it is foreseeable that if NCBPA could promote and expand on-bill financing programs throughout the state, it could enable homeowners to save energy through existing home retrofits.

In order to develop and expand on-bill financing programs, Appalachian Voices, the Environmental Defense Fund, the Southern Environmental Law Center, the Southern Alliance for Clean Energy, the Environmental Finance Center at UNC-Chapel Hill, and the Southeast Energy Efficiency Alliance collaborated together in 2015 to set up the North Carolina On-Bill Working Group (SEE Alliance, 2016). It would be beneficial if NCBPA could join this group to promote expansion of on-bill financing programs. Although NCBPA is more interested in PACE financing, it is more cost-effective for NCBPA to shift some of the effort from PACE financing into on-bill financing since promoting on-bill programs meets less resistance than residential PACE. In addition, since NCBPA already has connections with organizations within the working group, it would be helpful for them to collaborate to promote more on-bill programs across the state.

Another reason for NCBPA to promote on-bill programs is that electric co-ops, current on-bill program providers, are serving many rural and low-income areas that have less efficient homes. Studies show that the average cost burden for houses in rural electric cooperatives areas is roughly 20 percent more than houses in investor-owned utilities-served areas (McIlmoil, 2014). Energy efficiency retrofits, if targeted to families served by electric co-ops, can bring significant energy savings. Since those low-income families would be less willing to spend upfront cost for installing energy projects, on-bill programs would be the best choice. North Carolina's 26 electric cooperatives serve more than 2.5 million people in 93 counties (NCEMCS, 85...
Since electric coops have already gained the confidence of their customers, it would be an easy transition for co-ops to provide on-bill service to their customers.

Credit unions and community banks will become major players in energy efficiency retrofits in North Carolina. Large commercial banks in North Carolina only offer energy efficiency products when customers are buying new homes. Currently, no loan programs exist for energy efficiency retrofits (Environmental Finance Center at University of North Carolina at Chapel Hill, 2010). Besides, commercial banks, with a goal to maximize profits, generally require higher interest rates for loans. Credit unions and community banks however, provide lower interest loans to individuals. In North Carolina, energy efficiency loans from credit unions like State Employee’s Credit Union and Electel provide loans with interest rates in the 6-to-8 percent range; commercial banks often provide loans with interest rates above 20 percent (Environmental Finance Center at University of North Carolina at Chapel Hill, 2010).

Therefore, by expanding the loan size provided by credit union and community banks, low-income families that have a higher energy burden could access those loans for energy efficiency projects. Moreover, if those loans could reach the houses most in need of energy efficiency improvement, then on-bill loan programs would likely be the most effective financing mechanism to promote retrofits.

Another reason for NCBPA to explore more financing from credit unions and commercial banks is because those institutions are not only more experienced at lending to local single families, but are also adept at engaging more customers that are underserved by large banks in suburban and rural areas. Besides, credit unions and community banks, with their main goal to serve and help community development, have gained more confidence from local communities, making their loan programs more readily accepted by local homeowners. In
addition, North Carolina has a strong credit union presence, and those credit unions are becoming increasingly interested in financing energy efficiency and renewable energy projects. Utilizing connections with local community banks and credit unions, and promoting their willingness to make loans for home energy efficiency improvements, would be in the interest of both NCBPA and the working group.

Although credit unions and community banks could provide lower interest rate loans for their customers in on-bill programs, it is still not enough for broad installation of energy efficiency retrofits. One reason for this is that credit unions and community banks have certain requirements regarding the creditworthiness of loan applicants. Those program requirements exclude low-creditworthy homeowners and decrease program participation rates. Ironically, those low-creditworthy homeowners tend to live in older and less efficient houses that, if retrofitted, could result in higher energy savings than most other houses. Therefore, creating accessible capital for low-creditworthy homeowners becomes an important issue.

Another reason that loans provided by credit unions and community banks are not broadly adopted by electric cooperatives in North Carolina to develop on-bill programs is that interest rate requirements from those financial institutions are still high, making some homeowners unwilling to take on another loan. For instance, Roanoke Electric Cooperative in North Carolina was trying to develop an on-bill program with Self-Help Credit Union, but ended up receiving funds through Energy Efficiency & Conservation Loan Program (EECLP) offered by the Rural Utilities Service (RUS) (Roanoke Electric Cooperative, 2015). One main concern of Roanoke taking loans from Self-Help was that the high interest rate would decrease willingness of customers from Roanoke to install energy efficiency retrofits, thus making it hard for Roanoke to achieve large, energy-saving goals. One approach to solve this problem is by combining
federal funding with that from credit unions and community banks. Government funding could buy down interest rates, or be used to set up a loss reserve fund that could also lower both overall risk and interest rates.

**Recommendation 2: Continue efforts to promote commercial PACE financing to pave the way for residential PACE**

We recommend that NCBPA continue its persistent effort to get commercial PACE legislation through the North Carolina General Assembly. Not only will commercial PACE financing benefit the state’s building industry, it will pave the way for residential PACE legislation. This is often the case with PACE financing programs, as discussed earlier.

Evaluation of Sonoma County's Energy Independence Program (SCEIP), highlighted earlier, reveals lessons for future program design. One factor encouraging Sonoma County to install SCEIP was that Sonoma County had aggressive greenhouse gas (GHG) emission reduction plan to reduce their greenhouse gas emissions 25 percent below 1990 levels by 2015 (SCEIP, 2011). GHG emission plans and similar commitments will promote county and cities seeking ways to reduce energy usage. Thus, for a future PACE program to be implemented, it may be helpful if NCBPA chose a city or county like Durham, Ashville, or Charlotte with similar commitments.

In addition, in the middle of SCEIP’s development process, the program changed its grant instructions in order to support Department of Energy (DOE) guidelines, which dropped the program volume significantly. In order to avoid this, a clear program design with detailed instruction should be in place before a North Carolina PACE program is created. Collaboration between government, community and local agencies is an important factor influencing the success of a PACE program. In addition, most activities installed in SCEIP need help from community level outreach and engagement. SCEIP attended numerous events to educate
consumers, which increased homeowners’ awareness and encouraged them to take action. An outreach and marketing plan will be essential for the success of a PACE program during the program-design process. Also, contractor training in SCEIP is done within Sonoma County, so that job creation and economic benefits remain mostly within the county, which increased support from local communities. To gain support from local people in a future North Carolina PACE program, NCBPA could also state that contractor training and hiring must remain within certain areas, and make sure the economic benefit stays within that area.
Conclusion

Our project focused on identifying barriers preventing existing North Carolina homeowners from undergoing retrofit activities aimed at increasing home performance and efficiency. Our client, NCBPA, an association which represents many contractors, homebuilders, and interested parties throughout the state, maintains a vested interest in increasing retrofit activity. To approach the project, we reviewed available literature in the form of journal articles, white papers, industry reports, books, and other published resources surrounding the issue. Using these resources, we distilled a master list of cited barriers to retrofit activity. From this list, we organized the barriers into four major barrier categories: holes in consumer education, suppressed market valuation, financial hurdles, and improperly aligned marketing strategies. After establishing our four barrier areas, we developed recommendations specific to NCBPA regarding actions that should be used to address these roadblocks.

Holes in consumer education. After reviewing available literature, we found that when it comes to home energy, consumers are uncertain how their behavior translates into energy use. There is both an intellectual roadblock (consumers are confused by energy consumption in general) and a temporal disconnect (the “consequence” related to energy use comes too long after behavior). Homeowners also show a lack of understanding regarding which retrofits are most effective. They tend to show a preference for more flashy retrofits such as installing solar panels rather than engaging in more effective, yet less “glamorous” options, such as insulating their crawlspace. We also found that homeowners act irrationally when making decisions and are susceptible to being “nudged” toward better home energy decisions (perhaps through changing default options, the use of social comparison, or others means). Finally, we found that North Carolina homeowners are overwhelmed by the staggering amount of home energy certifications
and labels competing in today’s marketplace. Too many options tends to dilute their effectiveness in influencing home energy retrofit activity.

From our research on holes in consumer education, we developed two recommendations. The first recommendation aimed at addressing consumer education was to continue making efforts to bolster NCBPA consumer education website (www.HomeEnergyNC.org) by monitoring traffic, creating state-level interactive content, include relevant regional case studies and more. To eliminate the redundancy of consumer education websites, we recommend that NCBPA work with partner organizations to channel visitors to their website. To do this would require concerted efforts toward creating agreed-upon contact and sharing administrative and financial burdens associated with website management. Finally, we recommend they explore other advertising practices to bring in consumers. Some of these include radio, TV, social media, and, more specifically, the use of conjoint marketing.

To address the overwhelming amount of home energy certification programs operating in the state, we recommend that NCBPA focus efforts on promoting the U.S. Department of Energy’s Home Energy Score. We recommend this metric because it easily understood by consumers while also providing a comprehensive home energy assessment. It is also relatively cheap, easily administered, and backed by the federal government. The Home Energy Score also shows promise of being included in the home valuation process for home resale. Finally, our research shows that government initiatives incentivized by utilities tend to achieve quick adoption and have long time horizons (Duke Energy and ENERGY STAR™ appliances). We encourage NCBPA to continue pursuing efforts with Duke Energy to create a rebate program aimed at promoting the use of the Home Energy Score in North Carolina.

Suppressed market valuation. The literature clearly shows that energy efficient, high
performance homes provide obvious benefits to the homeowner. Some of these include financial savings, environmental responsibility through the reduction in energy and greenhouse gas emissions, and increased health and well-being. The value of new, energy efficient homes is evident in the home marketplace through selling for higher premiums and spending less time on the market. For used, retrofitted homes, this increased market valuation is not as well-proven. Part of this is because the re-selling process is often less stringent than the new home selling process. Also, energy efficiency measures are often overlooked during the home appraisal. This is because features are often hidden or unrecognized by inspectors. There is also no standardized energy score included in the valuation process.

To address the barrier of suppressed market valuation, we recommend that NCBPA create a position within the association dedicated to fulltime data management. There is a demonstrated need for data regarding where retrofits are taking place, details surrounding retrofits, the demographics of those pursuing retrofits and their motivating factors, as well as the resale value of high-performing homes. A fulltime data manager could work to answer some of these questions and help substantiate the reasons for pursuing home energy retrofits. We also recommend NCBPA create a “greening the MLS” working group. Of the 45 MLSs operating in North Carolina, only 5 offer “green feature search-ability”. Our research shows that successfully ‘greening’ involves deliberate stakeholder collaboration and that the biggest hurdles include deciding which green features to include and software changes. We recommend that NCBPA form a group in the Triangle area, start with local MLSs, be met with success, train others, and branch outward through the state. We believe these two recommendations will help address the issue of suppressed market valuation.

Financial hurdles. Perhaps the most largely recognized barrier to undergoing retrofits is
lack of homeowner capital. Related to the issue of consumer education, many homeowners believe that all retrofits require a lot of money. This simply is not true, as many of the more effective retrofits are relatively cheap and provide a high return on investment. For larger projects, we find that high upfront cost can discourage homeowners from undergoing retrofits. Two ways to address this include PACE financing and On-bill financing. PACE financing allows for energy efficiency upgrades by adding the cost of the project to the homeowner’s property tax bill. Usually taking 15-20 years to pay off, the tax is transferrable and remains with the home even if the homeowner sells their home. Commercial PACE is a similar program designed for commercial and industrial property owners. In our research, we found that states that enact Commercial PACE first are often met later with legislative success in enacting Residential PACE. On-bill financing allows for retrofits to be paid back by through monthly utility bills. It is cost effective and has a low, 3 percent default rate.

Given our finding surrounding financial hurdles, we recommend NCBPA continue to promote efforts to enable Commercial PACE financing in North Carolina. We believe that if they can get Commercial PACE financing underway in North Carolina, they will be able to more easily enable Residential PACE in the coming years. Also, we recommend NCBPA join the “North Carolina On-bill Financing Working Group”. This working group, founded in 2015, is made up of a number of regional and national organizations working in the state to help promote on-bill financing. We believe that by joining this working group, NCBPA can help be at the forefront of expanding on-bill financing throughout the state, and in doing so, work to assuage financial hurdles associated with home energy retrofits.

Improperly aligned marketing strategies. In researching marketing strategies surrounding home energy retrofits, we learned that energy choices are highly influenced by
social and psychological behavior as well as economic factors. We found that current marketing efforts are insufficient or comprised of strategies that fail to deliver the correct content to the correct consumer. The solution to this is a marketing plan that properly identifies the target audience and accounts for the energy efficiency attributes valued most by different segments. We explored conjoint marketing, which uses human behavior to sell a product or service. Through an analysis of how individuals assign value to various attributes of a product or service, it identifies the attributes more influential in the decision-making process. On the whole, conjoint marketing allows for the quantification of elements of consumer judgement and deeper insight into consumer preferences.

When it comes to home energy retrofits, we found that financial incentives may be overstated and that there is a primacy of economic and socio-demographic status including age stratification, household income, and education level. Younger homeowners with high household income and a high level of education show the greatest willingness to pay for home energy retrofits. Targeting this audience requires stressing energy-saving capabilities while also touting environmental benefits. With these things in mind, we identified the top North Carolina counties for NCBPA to focus on when employing a conjoint marketing approach. Aside from these priority locations, we also identified secondary and opportunity locations based on our marketing strategy findings.

**Going forward.** Overall, we believe that NCBPA is making a number of positive efforts to increase home energy retrofits in the state of North Carolina. To be certain, the association and its member companies and stakeholders are already saying, doing, and advocating for many of the things that will make home energy efficiency expansion a reality. Continuing to reinforce these efforts will undoubtedly pay dividends when it comes to increasing organic homeowner
demand for retrofits. We believe the state is moving in the direction of valuing energy efficient homes and that some of results of this movement will take time to be realized as many of the aspects of the identified barriers are conditionally based. That said, we believe that our recommendations are attainable for the association and likely to produce realistic, positive change toward addressing barriers to home energy retrofits throughout the state. If implemented, and coupled with ongoing efforts of NCBPA, the future of the home performance market in North Carolina is sure to be bright.
References


Appendix A: Figures and Tables

**Figure 7:** U.S. electricity consumption by sector (Quads) and percentage of total. *Data Source: EIA, 2013.*

**Figure 8:** U.S. CO₂ emissions by sector (million metric tons of CO₂ equivalent) and percentage of total. *Data Source: U.S. Department of Energy, 2013.*
Table 4: Third Party Verification and Certifications available in North Carolina

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<td>Enterprise Green Communities</td>
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<td>Green Globes Certification</td>
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<td>GreenBuilt North Carolina</td>
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High Performance Home Program
Home Energy House Call
Home Energy Score (HES)
Home Performance with ENERGY STAR™
LEED (additional programs)
LEED for Buildings
LEED for Homes
Living Building Certification
National Green Building Standard (existing)
National Green Building Standard (new)
Net Zero Energy Building Certification
North Carolina HERO/Stretch Energy Code
Passive House Institute US + Certification
PEARL Certification
Petal Certification
Remodeling NGBS Certification
SystemVision (existing)
SystemVision (new)

Figure 10: Median income in North Carolina counties for the year 2016. Source: NCOSMB, 2017.
Figure 11: Median age in North Carolina counties for the year 2016. Source: NCOSMB, 2017.

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<td>Days on Market</td>
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<td>Number of Homes Sold</td>
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### Appendix B: Useful Sources by Barrier Category

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<td>behavioral interventions, nudging, energy conservation, Opower</td>
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<td>Allen, S., Dientz, T., &amp; McCright, A.</td>
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<td>Ayers, I., et al.</td>
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<td>residential energy use, peer comparison feedback, Positive Energy, Opower</td>
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<td>Brounen, D., Kok, N., &amp; Quigley, J.</td>
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<td>Journal Article</td>
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<td>Dianshu, F., Sovacool, B., Minh Vu, K.</td>
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**Marketing**

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