North Carolina Energy Efficient and High Performance Home and Building Inventory Assessment
August 26, 2015
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Table of Contents

Energy Efficiency/High Performance Home Valuation ................................................................. 3
- Markets and Trends – EE/HP Certified Homes are Becoming the Common .................... 3
- EE/HP Real Estate Demand and Supply ............................................................................ 4
- Why Energy Efficiency Importance? ................................................................................ 5
- Third Party Certification and Verification ........................................................................ 5
- Value Added Propositions ............................................................................................... 6

NC Implementation of EE/HP Homes .................................................................................. 6
- High Performance Buildings in NC – Data Baselining .................................................. 6
- Data Set .......................................................................................................................... 7
- Methodology .................................................................................................................. 8
- NC – Where We’ve Been, Where We Are, and Where We Are Going! ...................... 8
  - Distribution by Year ..................................................................................................... 9
  - Comparison with Homes Built in the U.S. ................................................................. 9
  - Certification Programs ............................................................................................... 12
  - Distribution in NC ....................................................................................................... 13
  - Distribution by Building Types .................................................................................. 15
  - Existing Homes and Buildings EE/HP Certifications ................................................ 16

Challenges to Showing Benefits of EE/HP Certifications .................................................. 17
- Bridging the Gap on Valuation – Building Value Across the Market Sectors ............ 17
  - Lenders ....................................................................................................................... 17
  - Appraisers .................................................................................................................. 18
  - Real Estate Agents .................................................................................................... 18
  - Home Owner/Consumer ........................................................................................... 19
  - Builders/Construction Companies/Developers ....................................................... 19

Successful Directions ........................................................................................................ 20
- Creating the Knowledge Base and Keeping on the Tracking Route .......................... 20
- Communicating – Bringing Forth Behavior Change ...................................................... 20
- Creating the Win-Win through EE/HP Homes and Buildings! .................................. 21

References .......................................................................................................................... 22
Energy Efficiency/High Performance Home Valuation

The North Carolina Energy Efficient Homes and Building Inventory Project was developed through the NC Building Performance Association (NCBPA) in partnership with the Energy and Environmental Assistance Office of UNC Charlotte’s Energy Production and Infrastructure Center (EPIC). The project was developed to enable collecting and distributing data on the impact of energy efficiency / high performance (EE/HP) home and building projects across North Carolina. The project will provide an identification of positive and negative trends in the EE/HP home market, development of a database, access of the database to critical stakeholders, and creation of an advocacy campaign to improve consumer and business awareness.

Energy Efficient/High Performance (EE/HP) homes are yielding a higher level of quality and affordability with increased savings on utilities, while reflecting responsibility in environmental stewardship. EE/HP buildings have features which focus on energy efficiency with effective insulation, efficient windows, tight construction and ducts, efficient equipment and appliances, along with third party verification. These features can provide expected lower utilities costs; along with additional benefits of a home which is quieter, more comfortable, less drafty, less dust, fewer pests penetration, and less maintenance with improved indoor air quality. In addition to energy efficiency, other features could include water conservation products and practices, recycling, materials conservation, and environmental low impact development. Factors which contribute to the implementation of EE/HP include: Energy cost increase, higher quality, regulator change through codes or ordinances, availability and affordability of products needed, customer demand, increased lender and appraisal values, improved occupancy rates and incentives from utilities or government.

Markets and Trends – EE/HP Certified Homes Are Becoming the Common

Consumer who stated being “Very Likely” or “Somewhat Likely” to purchase products associated with a good cause, given similar price and quality, increased to 89%. “And it’s not just about getting people to buy something in the hopes of making a difference; it’s about responding to consumers’ demands to understand exactly how their actions are effecting positive change.” Bill Fleishman, CEO, Cone Communications (Cone Communications, 2013). It is important to understand the changing dynamics of purchasing power and interest, McGraw Hill Construction states its applicability and impact within the real estate markets from results in a 2014 study. “Green Multifamily and Single Family Homes: Growth in a Recovering Market”, reports on the increasing importance of Energy Efficient/High Performance (EE/HP) construction within single family and multifamily sectors. They state high quality and customer demands are important triggers in single family homes market; while multifamily homes markets are influenced by the factors which contribute to cost and recovery such as government or utility incentives along with enhancing the competitive position for rental. The current trends and projections for construction is provided in Table 1. This study illustrates that demands of the younger generation in seeking attributes addressing environmental concerns of high priority are currently present in rental properties through multifamily builders, as this generation ages the trends will become evident with a stronger presence in the single family homes market. As EE/HP features inclusions are at a cost to the builder, the McGraw-Hill
study provided a summary of how those features may be conceived within the percentage of additional cost to the homeowner; showing 68 -73% believe the consumer will pay up to 5% more (Figure 1).

*Table 1: Summary Table of Market Changes by McGraw Hill Construction, 2014.*

<table>
<thead>
<tr>
<th></th>
<th>Single Family Builders</th>
<th>Multifamily Builders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently, doing more than 15% of</td>
<td>62%</td>
<td>54%</td>
</tr>
<tr>
<td>project green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected by 2018, doing more than</td>
<td>84%</td>
<td>79%</td>
</tr>
<tr>
<td>15% project green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currently doing more than 60% of</td>
<td>34%</td>
<td></td>
</tr>
<tr>
<td>project green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currently, doing more than 90% of</td>
<td>19%</td>
<td>6%</td>
</tr>
<tr>
<td>project green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected by 2018, doing more than</td>
<td>38%</td>
<td>18%</td>
</tr>
<tr>
<td>90% project green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belief that consumers will pay more</td>
<td>73%</td>
<td>68%</td>
</tr>
<tr>
<td>for green (Up to 5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customers request for green homes</td>
<td>17%</td>
<td>35%</td>
</tr>
<tr>
<td>because they are better for the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market Share in 2016 Projections for</td>
<td>26-33% of market (Value</td>
<td></td>
</tr>
<tr>
<td>Single Family Homes</td>
<td>of $80 Billion to $101 Billion)</td>
<td></td>
</tr>
<tr>
<td>“Green Building” Market growth</td>
<td>300% from 2013 with $36 Billion to $105 Billion in 2016.</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 1: Magnitude of Customer Willingness to Pay (%) (McGraw Hill Construction, 2015)*

**EE/HP Real Estate Demand and Supply**

With the U.S. real estate market of $7.4 trillion in home purchases, $2.2 trillion in rent, and $700 billion in renovations, there is substantial reward for building the homes which will attract buyers to your offerings. Based on the “Housing Satisfaction Gap: What People Want, but Don't Have” survey report provided by the Demand Institute, respondents from over 10,000 households were asked questions
concerning a variety of concerns to homeowners and asked to rank them by importance. After gathering
their responses, analysts found that 71% of the households polled placed significant emphasis on energy
efficiency, while only 35% felt their own homes were energy efficient with a low monthly utility cost. A
desire for energy efficiency could drive renovations, maintenance and new technology use: for instance,
51% of households would consider buying an energy-use monitor (Demand Institute, 2014).

Even though the United States is slightly farther behind than many other developed countries when it
comes to energy retrofitting, ratepayer-funded programs across the country have grown tremendously
from $2.6 billion during 2006, to nearly $7 billion in 2011, while the number of participating states have
risen from 8 states in 2006, to 24 states in 2012 (ACEEE, 2012)

With commercial real estate leasing and aggressive consumption of EE/HP featured space, the evidence
is clear. Dr. Rob Cox, UNC Charlotte Associate Professor Electrical and Computer Engineering and Director
of the Sustainably Integrated Building and Sites (SIBS) Center, stated that within Charlotte’s commercial
properties the demand for EE/HP features has driven the market for leasing and provides the leading edge
competitive advantage (SIBS, 2015).

Why Energy Efficiency Importance?

According to the U.S. Energy Information Administration, the residential (22%) and commercial (19%)
sectors consumed 41% of the total U.S. energy (EIA, 2014). With households spending around $230 billion
each year on energy, excluding transportation the economic value of the energy efficiency improvements
of 20% would provide $41 billion in savings (McKinsey & Co., 2009). The U.S. residential utility customer
consumes an average of 909 kWh/mo with space heating (42%), Lighting and appliances (30%), water
heating (18%), air conditioning (6%) and refrigeration (5%) (EIA, 2009 Residential Energy Consumption
Survey). Energy efficiency features could include: highly efficient and properly sized HVAC and/or water
heater, energy efficient appliances, efficient lighting, and exceeding code minimums for insulation,
windows, and energy programs.

Additional evidence on the investment capability and economic generation of EE/HP buildings within the
energy sector in NC are the findings of NC Sustainable Energy Association’s Clean Energy Census for
domination of the clean energy sector type (38% with 833 firms), full time equivalent employees (49%)
and top revenue generator at $1.9 Billion (39%) (NCSEA, 2013).

Third Party Certification and Verification

Third party verified energy efficiency programs are increasing in demand and seek to provide more
efficient buildings. ENERGY STAR program can reduce home energy consumption by 15% compared to
homes built in 2004, and include features providing greater efficiency than code-built home by 20-30%.
The ENERGY STAR program has gained 16% of the market penetration in the new home market, with
Home Performance with ENERGY STAR program (HPwES) expanded from 76,000 homes in 2009 to
313,000 homes through September 2013 (US EPA, 2014). The Residential Energy Services Network
(RESNET) states that the Home Energy Rating System (HERS) rated homes quantity soared to almost
219,000 in 2013, a 70% increase over 2012 (RESNET 2014).

The options within the building markets are varied for EE/HP buildings and homes third party certifications
and third party verified certifications. Third party certification with verification allows the homeowner
valid data of the performance within the EE/HP features meeting the provisions of the selected certification program; it ensures builders and contractors compliance and understanding, and provides specific documentation to allow appraisers and lenders knowledge of the value. Energy efficiency certifications with third party verification can aid in the acceleration of market adoption and provide value measuring capability for energy efficient homes.

Value Added Propositions

Research has been completed to provide data on the value obtained through construction implementing EE/HP features. The North Carolina Energy Efficiency Alliance (NCEEA) showed that ENERGY STAR qualified new homes were selling 89 days faster and $5,566 higher premium price than code built ones for the Raleigh-Durham-Chapel Hill, NC (Triangle Area - five county region). Other researchers have shown 4.2-13.8% premium pricing with information provided in Table 2.

Table 2: Comparison of EE/HP and Code Built Homes

<table>
<thead>
<tr>
<th>Premium Price</th>
<th>Fewer Days on the Market</th>
<th>Location</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5,566 more</td>
<td>89 days</td>
<td>Raleigh-Durham-Chapel Hill, NC</td>
<td>NCEEA, 2011</td>
</tr>
<tr>
<td>12.9 % more</td>
<td>42 days</td>
<td>Raleigh, Durham, Chapel Hill, NC</td>
<td>Argeris, 2010</td>
</tr>
<tr>
<td>13.88% (Avg from 2007-2010)</td>
<td>None</td>
<td>Asheville, NC</td>
<td>Mosrie, 2011</td>
</tr>
<tr>
<td>9.6% more</td>
<td>None</td>
<td>Seattle, WA</td>
<td>Griffin, 2009</td>
</tr>
<tr>
<td>4.4% more</td>
<td>31 days</td>
<td>Atlanta, GA</td>
<td>Carson, 2009</td>
</tr>
<tr>
<td>4.2% more</td>
<td>18 days</td>
<td>Portland, OR</td>
<td>Griffin, 2009</td>
</tr>
<tr>
<td>$4,576 more</td>
<td>24 days</td>
<td>Chicago, IL</td>
<td>Elevate Energy, 2014</td>
</tr>
</tbody>
</table>

NC Implementation of EE/HP Homes

High Performance Buildings in NC – Data Baselining

Data baselining was completed in partnership with the NC Building Performance Association (NCBPA) and the Energy and Environmental Assistance Office of UNC Charlotte’s Energy Production and Infrastructure Center (EPIC) to collect, analyze, and distribute data on the impact of home and building energy efficiency / high performance projects across North Carolina. Data is essential to enhance the validation, clearly communicate and measure the value and benefits of EE/HP buildings through the market sectors of home builders, real estate agents, appraisers, lenders, and home buyers/sellers.
Data Set

NCBPA collected data from companies that currently house zip code level information on the homes and buildings which have been retrofitted, rated, or certified to agreed-upon energy efficiency and high performance standards. Data collected included categories for company/contractor name, job completion date, program ID, new or existing building, building type, energy efficient category, score or metric (numerical), program reference, address disclosure (yes/no), address, city, state, zip code, county, and climate zone. Data was collected from 24 sources for certified energy efficient homes who contributed 51,084 validated data points for this study, representing 121,919 EE/HP building certifications. These sources are shown in Table 3.

Table 3: Quantity and Sources of Data

<table>
<thead>
<tr>
<th>Data Provider</th>
<th>Building Data Set</th>
<th>Units Data Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENERGY STAR</td>
<td>12,043</td>
<td>53,274</td>
</tr>
<tr>
<td>RESNET</td>
<td>1,644</td>
<td>29,773</td>
</tr>
<tr>
<td>Performance Point</td>
<td>15,236</td>
<td>15,236</td>
</tr>
<tr>
<td>Above and Beyond Energy</td>
<td>6,697</td>
<td>6,697</td>
</tr>
<tr>
<td>Progress Energy Home Advantage Program</td>
<td>3,659</td>
<td>3,659</td>
</tr>
<tr>
<td>USGBC NC</td>
<td>2,968</td>
<td>4,378</td>
</tr>
<tr>
<td>Home Innovation Labs (NGBS)</td>
<td>2,303</td>
<td>2,303</td>
</tr>
<tr>
<td>Advanced Energy</td>
<td>1,738</td>
<td>1,738</td>
</tr>
<tr>
<td>Duke Energy Progress RNC Program</td>
<td>1,480</td>
<td>1,480</td>
</tr>
<tr>
<td>VandeMusser Design, PLLC</td>
<td>1,144</td>
<td>1,144</td>
</tr>
<tr>
<td>WNCGBBC</td>
<td>1,029</td>
<td>1,029</td>
</tr>
<tr>
<td>ESRA Facility Management &amp; Consulting</td>
<td>352</td>
<td>352</td>
</tr>
<tr>
<td>Homes by Dickerson</td>
<td>339</td>
<td>339</td>
</tr>
<tr>
<td>Environmental Solutions Group</td>
<td>221</td>
<td>286</td>
</tr>
<tr>
<td>Habitat for Humanity Charlotte</td>
<td>153</td>
<td>153</td>
</tr>
<tr>
<td>Greater Mount Airy Area Habitat for Humanity</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Blue Ridge Energy Systems</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Cady and Guyton Construction</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Rare Earth Builders, Inc.</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>S W Associates</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Mitchell-Yancey Habitat for Humanity</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Passive House US</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Mountain Sun Building &amp; Design</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Vincent Building, Inc.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>51,084</strong></td>
<td><strong>121,919</strong></td>
</tr>
</tbody>
</table>

The first step in developing the data baseline was to create a data set of information obtained by the NCBPA team. The initial data evaluation has been completed to provide information in support of the strength of the EE/HP building third party certification programs in NC. It is based on the received sample
set which was provided. It is not a representative statistical sampling set with both certified and non-certified homes designed. Therefore, the current evaluation will be useful in showing the trends for EE/HP buildings in NC from 2006 – 2015*. (*It should be noted that 2015 data set is only a partial one, due to buildings currently still under construction and some of the contributing partners did not provide any data from 2015.)

Methodology

The original data set received from NCBPA had 75,673 building data set entries. As it was critical to provide information on the number of buildings certified for energy efficiency in NC, the specific addresses were analyzed to ensure that each represented a unique building certified for EE/HP. After evaluation of the data set, it was discovered within those entries with specific street number and name information (47,032 data points) there were duplicate data records for the same home. These records were assessed to determine whether duplicates were from the same source and certification methods. Duplicate data entries for the same home and certification methods were removed from the data set. The data may have been reflective of the certification company providing more than one certification for a home, it was deemed necessary to represent the number of homes being certified in NC not the number of certifications performed. The data set was analyzed and validated to remove duplicate specific street addresses, zip codes and addresses which were not located in North Carolina (Atlanta GA, Cumming GA, Irmo, SC, and NewPort News VA) and buildings that had not been fully certified. The final data set evaluated was 39,555 data entries sample set. Further evaluations of the data were performed through the certified building density mapping for the development of specific hot spot analysis and heat mapping through ARC GIS software.

GIS Analysis

The data collected by the North Carolina Building Performance Association (NCBPA) was analyzed by the Energy & Environmental Assistance Office (EEAO) at UNC Charlotte using ArcMap 10.1. ZIP codes obtained by the NCBPA were used to assign geographic reference to the data. The data chosen for analysis had two characteristics; verified energy efficiency rating system and a verifiable ZIP code. The precise address was not available for all chosen data. It was not feasible to assign precise geographic coordinates to the reported structures. Instead, the number of data points for each ZIP code were randomly distributed among each zip code polygon. The total number of points, after filtering for the two aforementioned specifications, was 39,555. A point density analysis was run to generate a “heat map”. This provided a visual representation of the densities of these points per square mile. A statistical hot spot analysis was run in ArcGIS 10.1 as well to evaluate statistical significance. The counties in North Carolina that showed relevant data were distributed into one of 3 groups: Combined Statistical Area (CSA), Metropolitan Statistical Area (MSA) and Micropolitan Statistical Area (µSA). These groups were established based on methods established by the US Census.

NC - Where We’ve Been, Where We Are, and Where We are Going!

North Carolina has been a leader in providing third party verification for homes with certifications in energy efficiency and high performance. Within the ENERGY STAR program’s ranking of states with ENERGY STAR Certified Homes Market Share Greater than National Average, NC is ranked 8th with 18.28% as compared with the national average of 11.81% (EPA, 2015). In 2014, Residential Energy Services
Network (RESNET) program ranked NC 3rd in leading the industry with the RESNET HERS Raters and HERS Index Score with 10,271 homes with an average score of 63. (RESNET, 2014). The US Green Building Council recognized NC as a leader in 2013, with it being ranked 7th highest in the nation for LEED building with 133 projects representing 17 million square feet of real estate (USGBC, 2013).

**Distribution by Year**

Even with changes in certification programs throughout the years, NC programs have been moving forward with a significant annual growth. As a leader within the industry, NC has shown progressive implementation in providing value in building performance through certifications with an increase growth of 255% from 2010 to 2014.

![Figure 2: Distribution of Energy Efficient Homes and Buildings Certifications by Year](Note: 2015 Partial year not included)

**Comparison with Homes Built in U.S.**

Home building in the U.S. was at an all-time high in 2006, with 1,654,000 homes being built throughout the U.S. shown in Figure 3. The south region of the U.S. was shown to have the highest rate of growth for new construction with buildings completed being 826,000 in 2006 (Figure 4).
In the U.S., overall growth from 2000-2006 was 33%, with a downturn in the construction market and loss of growth from 2006-2011 at 73%. Growth began back from 2011-2015 at 40%. Growth levels over the last 4 years have been slightly greater than before the market crash of 2007-2008 (Figure 5).
Figure 5: Percent Growth in Completed Homes Constructed in the South

Figure 6: Growth comparison for US Homes in the South and NC new EE/HP Homes (Note: 2008 Growth% off chart)
It must be noted that the trends are of significance not the actual % value; since the data set is limited. Trends between total homes built per year in the south and total EE/HP homes built in NC can be seen through their percent changes shown in Figure 6. The data illustrates a consistent new home market 2003-2007, until the market crash in 2008 –resulting in a sharp decline in overall home production (shown in blue). EE/HP home completion rates (shown in green) however experienced immense growth in 2008, followed by a continual yearly growth. The 2008 data shows a growth rate of over 1200% from 2007. A total of 5,008 homes were recorded in 2008, while 360 were recorded in 2007.

**Certification Programs**

Third party certified EE/HP programs include: ENERGY STAR, HERS label homes, the National Green Building Standard (NGBS), ecoSelect, LEED, and NC Green Built. There were 29 third party certification programs included within the data set. The certification program with the highest usage was ENERGY STAR certified homes at 53.2%. The rankings for certification programs usage are included in Table 4 and shown in Figure 7. A summary table of the certification programs is included in Appendix A.

**Table 4: Certification Programs with Highest Usage**

<table>
<thead>
<tr>
<th>Certification Programs</th>
<th># Certifications</th>
<th>% Of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENERGY STAR Certified Homes</td>
<td>52,258</td>
<td>53.2</td>
</tr>
<tr>
<td>HERS Rating</td>
<td>35,097</td>
<td>35.7</td>
</tr>
<tr>
<td>LEED</td>
<td>2,682</td>
<td>2.7</td>
</tr>
<tr>
<td>2008/2012 NGBS</td>
<td>2,303</td>
<td>2.3</td>
</tr>
<tr>
<td>SystemVision</td>
<td>1,722</td>
<td>1.8</td>
</tr>
<tr>
<td>Duke Energy Progress Residential New Construction Program</td>
<td>1,481</td>
<td>1.5</td>
</tr>
<tr>
<td>ENERGY STAR Buildings and Plants</td>
<td>1,242</td>
<td>1.3</td>
</tr>
<tr>
<td>GreenBuiltNC</td>
<td>1,040</td>
<td>1.1</td>
</tr>
</tbody>
</table>

**Figure 7: Certification Method Implementation By Year**

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>2008</td>
<td>5,008</td>
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<td></td>
<td></td>
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<tr>
<td>2009</td>
<td>5,008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2010</td>
<td>5,008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2011</td>
<td>5,008</td>
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<td></td>
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<td>2012</td>
<td>5,008</td>
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<tr>
<td>2013</td>
<td>5,008</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>2014</td>
<td>5,008</td>
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</tbody>
</table>
As all the certification information within the data set does not have specific number and street locations, it is not possible to ensure that certifications were not double listed for the same homes. However, the information does reflect the increase in the usage of EE/HP certifications. An evaluation of the certification methods individually as shown in Figure 8, reflects the individual growth within the programs. It should be noted that the current year is still underway with incomplete data set along with the fact that the HERS Rating program (RESNET) did not participate with information for 2015, therefore 2015 is not included.

![Certification Method Implemented by Year](image)

**Figure 8: Certification Method Growth By Type**

**Distribution in NC**

There were 39,555 data points collected by NCBPA analyzed by the Energy & Environmental Assistance Office (EEAO) at UNC Charlotte using ArcMap 10.1 software. A point density analysis was run to generate a “heat map” to provide a visual representation of the EE/HP certifications per square mile across NC. An evaluation of zip codes was completed to ensure that the zip codes were verified to be located within NC. The zip codes with EE/HP certified buildings are shown within the NC map with county overlay in Figure 9 to provide an overview of the counties which have EE/HP homes being built within them. A statistical hot spot analysis was run in ArcGIS 10.1 as well using Cluster and Outlier Analysis (Anselin Local Moran’s I) (Spatial Statistics) for a confidence level of 0.05 it provides in Figure 10 an overview of green High – High (HH) and red Low-Low (LL) areas with statistical significance.
The counties in North Carolina that showed relevant data were distributed into one of 3 groups: Combined Statistical Area (CSA), Metropolitan Statistical Area (MSA) and Micropolitan Statistical Area (µSA). These
groups were established based on methods established by the US Census. A point density analysis was run to generate a “heat map” to provide a visual representation of the densities of these points per square mile shown in Figure 11. The data set provides evidence of the leadership in NC, there are significant quantity of units being built in Charlotte and Raleigh –Durham area. The interest across NC is reflected by the large quantity of blue dots (density mapping Figure 11) and zip code areas included (Figure 9) within EE/HP homes and buildings.

ENERGY EFFICIENT HOMES & BUILDINGS IN NC
This map is representative of structures built with confirmed energy efficiency certifications and verifications.

![Density Map of NC EE/HP Buildings](image)

**Figure 11: Density Map of NC EE/HP Buildings**

**Distribution by Building Types**

The distribution by building types within the data set was mainly residential single family homes (105,196) ranging from 84-97% within each year since 2008 (Figure 12). There were 2,382 residential multifamily homes representing a peak of 20% in 2011. However within these multifamily residents, it represents 10,642 family units providing an overall magnification of impact increase of 347%. The significance of the multifamily units is the potential impacts of benefits within a wider range of families and a larger set of homeowners/renters in understanding the value of EE/HP certification.

Commercial buildings were the starting focus of EE/HP building certifications, with 64% in 2003 being done for existing and new buildings in NC, while single-family residential buildings represented only 36%.
The trend toward EE/HP building certifications into residential single family homes grew from 31 homes in 2003 to 28,911 homes in 2014. The commercial buildings certification market percentage had a range of 20-64% prior to 2008, afterwards representing only 1-2%.

Figure 12: EE/HP Certifications on New Construction by Building Type

Existing Homes and Buildings EE/HP Certifications

An analysis of the existing homes and buildings seeking EE/HP Certifications provided insight into the shift in this market from commercial to residential. In 2014, single-family building accounted for 97% of certified buildings, while commercial certifications accounted for less than 1% (Figure 13).

Figure 13: Existing Buildings with EE/HP Certification by Type and Year
Challenges to Showing Benefits of EE/HP Certification

The construction of EE/HP certified homes will continue to increase. As a leader within the industry, NC has shown progressive implementation in providing value in EE/HP building performance through certifications with an increase growth of 255% from 2010 to 2014. The consumer market demand for EE/HP certified homes is climbing from an all-time high upward. Cresent Communities, Charlotte, NC has seen the value and has made a commitment to be a leading company using corporate and social responsibility (CSR) as a strategic driver of competitive advantage and an opportunity to unlock innovation and value (Cresent Communities, 2015).

As one reviews the market value demand, a competitive advantage becomes evident for all levels of the process for EE/HP buildings (appraisers, lenders, real estate agents, homeowner and the builder) to be at the forefront with capability and understanding of the technology, values, and benefits. The technology and capabilities are evident and proven to improve energy efficiency and performance, with data to document the value and outreach to bring understanding the EE/HP third party verified certifications can be utilized to bring value to all.

One challenge becomes finding ways to make energy improvements more affordable. This may be achieved through a variety of avenues: i) utility companies are recognizing the impacts and providing incentives and rebates, ii) financing options through lenders with long-term pay options which match the long-term value, iii) payment with property taxes or utility bills, iv) having higher appraisal value for leveraging the loan, and v) recognition of the savings on the family income from the energy improvements to gain income for loan payments.

Bridging the Gap on Valuation - Building Value across the Market Sectors

The challenge becomes magnified across the different market sectors and process steps for home sales. Lack of standardization on energy efficient homes and how its attributes are documented, reported, and shared represents a major dysfunctionality of EE/HP homes marketing. Data is essential to clearly communicate and measure the value and benefits and build the validation of EE/HP buildings through the market sectors of real estate agents, appraisers, lenders, home builders, and home buyers/sellers. Below is a summary listing of the challenges and implementation ideas that may exist across these sectors:

LENDERS:

Challenges:

- Lower utilities cost of EE/HP homes not included within consideration of owners capacity for financial payments of mortgages.
- Risk premiums are generally considered same as code homes; however, experience has shown there is less risk within the EE/HP homes; as homebuyers are finding more satisfaction and staying longer fulfilling the debt of the home. Institute for Market Transformation (IMT) a nonprofit organization based out of Washington D.C. examined 70,000 mortgages nationwide and found the odds of default on Energy Star rated homes a third less than conventional
residences at 32% (Kaza, et.al, 2014). It was also noted that the odds of prepayment which decreases the profitability level for lenders was 28% lower.

**Implementation Ideas:**

- Promote EE/HP building measures through direct linkage to traditional residential mortgages within the mainstream of financial markets.
- Include energy efficient renovations with mortgages for existing homes and refinancing.
- Provide greater promotion of the Energy Efficient Mortgages (EEM) backed by Federal Housing Administration and Dept. of Veterans Affairs.
- Provide premium value within the loans for lower risk; for example lower interest rates, more flexible credit profile.
- Provide for higher debt to income ratio with considerations for lower monthly utility costs.
- Develop information to enable wide spread education for lending industry on advantages of EE/HP homes.

**APPRAISERS:**

**Challenges:**

- Accurate reporting of value of EE/HP features. With features not being valued or ignored, the appraisal report will not provide a clear accounting of the home’s value; which in turn would prevent the loan amount to cover the cost and make the homes outside of the reach to many home buyers.
- Scope of work for appraisers are generally fee paid ~$200; with 34 different ways to certify a home in NC with energy efficiency the understanding of the benefits are confusing. As such a consistent benefit and value is hard to quantify with the specifics of each home having different versions and energy efficient mechanisms.
- Impacts of EE/HP homes are minimized with more changes in the certification/verification programs and values.

**Implementation Ideas:**

- Collect the data and seek for consistency in measurement of value to provide appraisers the baseline in establishing the value of EE/HP Homes.
- Seek for consistency of data to allow validation and comparison.
- Provide communication between the energy rater/verifier and the appraiser, leave the report and contact information for the appraiser.

**REAL ESTATE AGENTS:**

**Challenges:**

- EE/HP home features may not be showcased within the MLS.
  - If the features are listed, it may be limited in options to choose.
- Different fields for energy efficiency and performance in sales listings within the MLS.
- Difficult to quantify the value of the EE/HP features.
- Risks involved with overstating the value.


**Implementation Ideas:**

- Collect data to create the needed valuation of the features of EE/HP within a home that can be accepted and implemented.
- Work with the MLS process to get MLS listing areas for the EE/HP features.
- Work with potential owners to aid their understanding of lower utilities cost, premium home resale value and less time on the market.
- Enjoy the benefits of premium pricing and faster market sales timeframe.
- Understand the capabilities to increase customer satisfaction with homes that cost less to own, have improved air quality and are more comfortable, and require less maintenance.

**HOME OWNER/CONSUMER:**

**Challenges:**

- High upfront cost of energy efficiency features may prohibit potential homeowners in moderate to low-income accessibility to EE/HP homes.
- Costs may be above the mortgage level sought and difficult to finance.
- Difficult to understand the value to the home owner for the energy efficiency and home performance.

**Implementation Ideas:**

- Creation of home mortgages where the energy efficiency features are included.
- Creating affordable housing and lending mechanisms will enable a broader adoption market and rate of adoption for energy efficiency. The created utility savings enables capability for home owners within fixed income; if recognized within the lending / appraisal process.
- Documented energy savings on utility bills will incentivize owners to seek homes with EE/HP certifications; ENERGY STAR deliver about 20% savings (EPA ENERGY STAR, 2015).
- Educate home owner on the value of EE/HP homes as a better built home with increased comfort and indoor air quality, lower monthly utility bills, and improved environment stewardship than a code-built home.

**BUILDERS/CONSTRUCTION/DEVELOPERS:**

**Challenges:**

- Need an accurate value of EE/HP features recognized by market, or consumers to yield payback of investment. With features not being valued or ignored, the builder/construction/developer fails to regain investment and loses interest in pursuing EE/HP housing development.
- Continued implementation of energy efficiency features within homes. In general, homes built in 2000’s (36,000BTUs) have increased in energy efficiency (21%) when compared with homes built prior to the 1970s oil embargo (47,000 – 50,000BTUs) (Joint Center for Housing Studies, 2013). Yet, with increased sizes of homes the net gain is not recognized; it is mainly a negating of the increased sizing needs for homes 30% larger only showing a net increase of 2% (EIA, 2015).
Implementation Ideas:

- Collect the data and promote the advantages of EE/HP homes. As shown in Table 2, when homes can be sold faster and for higher pricing the developer can continue to provide funding within the company to build the next homes.
- Continue the upward trends of energy efficiency.
- Provide communication between the energy rater/verifier and the appraiser, leave the report and contact information for the appraiser within the built homes.
- Build marketing campaigns to highlight the improvements within EE/HP homes to consumers and the company’s commitment and successes.

Successful Directions

Creating the Knowledge Base and Keeping on the Tracking Route

This project has developed a database with over 75,000 EE/HP homes within its tracking potential. The information has been highlighted within this technical report and a white paper created to enable further outreach of the information toward educating the builders, realtors, appraisers, lenders, and homeowners. A presentation was provided during the NC Building Performance Association Conference on September 2nd to enable a project overview and dynamic discussion of how success can continue with additional dissemination of information and collection of data to provide the tangible benefits needed from data collection. It is recommended that data collection and dissemination continue for EE/HP Certified Buildings. The data becomes a critical factor in providing the validity of the results. Additional work to provide a statistical valid data set including general construction, home sales cost and timeframes, and energy efficiency savings will enhance the knowledge on EE/HP buildings values.

Communicating - Bringing forth Behavior Change

The capability to bring forth behavior change within the different aspects of the industry starts with communication and dissemination. A project with Center for Neighborhood Technology (CNT) Energy and National Home Performance Council developed a seven step process: Unlocking the Value of an Energy Efficient Home, A Blueprint to Make Energy Efficiency Improvements Visible in the Real Estate Market (CNT, 2014):

Step 1: Document energy efficiency features and improvements using consistent, standardized methods. Step 2: Disclose inventories of energy efficient homes to track supply. Step 3: Capitalize on existing high-quality continuing education and designation training. Step 4: Work with the MLS community to ensure that data about home energy efficiency improvements are incorporated into for-sale listings. Step 5: Ensure that the data about home energy efficiency improvements are incorporated into the appraisal process. Step 6: Develop standards and IT solutions that allow quicker and more automated transfer of data. Step 7: Work with partner financial institutions to ensure selection of qualified appraisers.
As shown with the UNC Charlotte EPIC EEAO and Communication Studies Department research seeking behavior change for disposal of fats, oils, and grease; media richness theory may be linked for application purposes with diffusion theory, suggesting people undergo a sequential pattern from awareness to adoption of a new idea (Scott, Cliff, et. al, 2012). Creating true success with increased awareness and adoption of behavior change when one experiences how the improvements affect the individual’s life.

![Information Diffusion Process toward Behavior Change](image)

Implementing behavior change for the appraiser will create value the lender can use to enable more mortgage capabilities in providing more buying capital to the home owner/consumer to purchase a greater volume of homes which will incentivize the builders to create more EE/HP homes. Therefore, the builders can seek to produce additional homes in meeting the increased market demand of future home buyers. The homeowners can have more energy efficient homes. The lenders can create less risky loans with higher value increasing the demand.

*Creating the Win-Win Through EE/HP Homes and Buildings!*

“Duke Energy Progress is working with builders across its service territory to build better and more efficient homes. Through the Duke Energy Progress Residential New Construction (RNC) program, homes that meet the 2012 NCECC High Efficiency Residential Option (HERO) are designed and built to increase energy savings. A builder meeting HERO requirements is producing an independently verified higher performing home. A buyer who purchases a qualifying home through the RNC program is choosing savings in energy costs, as well as better quality construction and enhanced comfort. The RNC program has 395 participating homebuilders which have incorporated energy efficiency measures in over 5000 homes resulting in over 10,000,000 kWh savings.” Mark Tabert, Duke Energy Progress, Product and Service Manager, Residential New Construction.

“The [third party verified certification] program chosen will depend largely on their client(s), location, type of structure and their individual goals for building “beyond code”. One thing for certain, it appears NC professionals are ready and willing to use these programs. The continued availability and growth of these programs in NC is a win-win across the board. The benefits and opportunities created reach all industry professionals, as well as better inform NC consumers. From job creation, to better buildings, to marketability these 3rd party certification programs offer it all.” (NCEEA, 2013)
References


EIA, 2015, Newer U.S. homes are 30% larger but consume about as much energy as older homes, http://www.eia.gov/consumption/residential/


North Carolina Energy Efficiency Alliance, 2013, “Reporting on 3rd Party, Certified, High Performance Units Built in NC”, 2013, info@ncenergystar.org


### Appendix A

#### Summary Table of Certification Programs within the Data Set

<table>
<thead>
<tr>
<th>Certification Program</th>
<th>Count</th>
<th>Website Links</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENERGY STAR Certified Homes</td>
<td>52,258</td>
<td><a href="https://www.energystar.gov/index.cfm?c=new_homes.hm_index">https://www.energystar.gov/index.cfm?c=new_homes.hm_index</a></td>
<td>Energy Star new homes produce an energy savings of up to 30% when compared to typical new homes, by being built with the strict energy efficiency guidelines set by the EPA.</td>
</tr>
<tr>
<td>HERS Rating</td>
<td>35,097</td>
<td><a href="http://www.resnet.us/hers-index?">http://www.resnet.us/hers-index?</a></td>
<td>HERS rating measures the energy efficiency of a home, the lower the HERS index score the more efficient the home. Decreasing the score will improve the homes comfort level, reduce energy costs, and make the home more environmentally friendly.</td>
</tr>
<tr>
<td>LEED For Homes Single Family</td>
<td>2,682</td>
<td><a href="http://www.usgbc.org/cert-guide/homes">http://www.usgbc.org/cert-guide/homes</a>, <a href="http://leed.usgbc.org/homes.html">http://leed.usgbc.org/homes.html</a></td>
<td>&quot;LEED certification means healthier, more productive places, reduced stress on the environment by encouraging energy and resource-efficient buildings, and savings from increased building value, higher lease rates and decreased utility costs.&quot; -LEED website</td>
</tr>
<tr>
<td>2008/2012 NGBS</td>
<td>2,303</td>
<td><a href="http://www.homeinnovation.com/services/certification/green_homes">http://www.homeinnovation.com/services/certification/green_homes</a></td>
<td>National Green Building Standard - A new green home can be awarded a Bronze, Silver, Gold, or Emerald certification level, depending on the number of green practices successfully incorporated in its design and construction. Existing single-family homes can also attain one of the four levels of certification when remodeled according to the requirements of the NGBS.</td>
</tr>
<tr>
<td>NC Single-Family SystemVision</td>
<td>1,722</td>
<td><a href="http://www.advancedenergy.org/portal/systemvision/?page_id=678">http://www.advancedenergy.org/portal/systemvision/?page_id=678</a></td>
<td>SystemVision homes are 15% more energy efficient than code built homes, this correlates to savings on utility bills.</td>
</tr>
</tbody>
</table>