

## **ABSTRACT**

CHEVALIER, MONICA J. Master of Natural Resources- Policy and Administration Technical Option. Energy-Efficiency Standards of Federally Funded Housing Rehabilitation Programs in North Carolina. (Under the direction of Drs. Sarah T. Warren and Gary B. Blank).

Approximately one-third of the homeowners and half of the renters in North Carolina live in non-affordable homes, spending more than 30% of household income on housing costs, including utilities. With the increasing electric utility rates in North Carolina, costs associated with home energy consumption are becoming a larger portion of housing costs. Low-income homeowners do not have the financial resources to make energy-efficient improvements to their homes to decrease housing costs, and therefore seek government assistance. However, depending on the government program, energy-efficiency may not be the primary objective, or even a priority. The North Carolina Community Development Block Grant (CDBG) and HOME Investment Partnerships (HOME) programs, funded by the United States Department of Housing and Urban Development (HUD), are two housing rehabilitation assistance programs available in the state for low-income households.

The goals of this research were to 1) examine if the homeowner needs of energy-efficiency match the priorities of HUD-funded housing rehabilitation programs in the state, and 2) investigate the process of integrating energy-efficiency policies into the HUD programs and make recommendations to modify program administration. Public documents and data from government agencies were examined to: 1) compare the eligibility criteria of the two programs, 2) identify energy and electricity usage and costs of the state's residential sector, 3) identify the state's low-income household demographics and housing

characteristics, 4) identify federal and state standards and policies that successfully integrate residential energy efficiency, 5) identify HUD's energy efficiency policies, and 6) identify which of North Carolina's HUD-funded programs do not integrate energy-efficiency into housing rehabilitation assistance.

Project findings indicate that households with the greatest need for affordable housing and affordable energy assistance reside in the eligible service areas of the state's CDBG and HOME housing rehabilitation programs. The state's CDBG program did not integrate HUD's recommendation of implementing ENERGY STAR standards, but the state's HOME program requires ENERGY STAR standards as of 2013. In addition, budget restrictions have contributed to administrative gaps in both programs, limiting program capacity to meet the affordable, energy-efficient housing needs of low-income households in the state. Therefore, in preparation for the state's 2016-2020 plan, the state administrative agencies must strengthen positive partnerships, enhance education for policy decision-makers and homeowners, conduct community outreach, seek support from governing bodies, and obtain guidance on feasible options to reinvigorate the programs with energy-efficient standards for housing rehabilitation.

Energy-Efficiency Standards of Federally Funded Housing  
Rehabilitation Programs in North Carolina

by  
Monica J. Chevalier

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APPROVED BY:

Dr. Sarah T. Warren, Committee Co-Chair  
Dr. Gary B. Blank, Committee Co-Chair  
Dr. Sarah D. Kirby, Committee Member

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## LIST OF ACRONYMS AND ABBREVIATIONS

ACS	American Community Survey within the United States Census
AEO	Annual Energy Outlook
AER	Annual Energy Review
CAPER	Consolidated Annual Performance and Evaluation Report
CDBG	Community Development Block Grant
C.F.R.	Code of Federal Regulations of the United States
CFC	Commerce Finance Center within the North Carolina Department of Commerce
CPD	Office of Community Planning and Development within the United States Department of Housing and Urban Development
DCA	Division of Community Assistance within the North Carolina Department of Commerce
DOE	Department of Energy
EERE	Office of Energy Efficiency and Renewable Energy within the United States Department of Energy
EIA / U.S. EIA	Energy Information Administration within the United States Department of Energy
EMC	Electric (Membership) Cooperatives
EPA	United States Environmental Protection Agency
ESG	Emergency Solutions Grants
HCDA	Housing and Community Development Act of 1974
HERS	Home Energy Rating System
HOME	HOME Investment Partnerships
HOPWA	Housing Opportunities for Persons with AIDS
HPwES	Home Performance with ENERGY STAR
HUD / U.S. HUD	United States Department of Housing and Urban Development

IDIS	Integrated Disbursement and Information System
IECC	International Energy Conservation Code
IOU	Investor-owned Utility
LEED	Leadership in Energy and Environmental Design
LMI	Low- and moderate-income
NC / N.C.	North Carolina
NCEC	North Carolina Energy Conservation Code
NCEMC	North Carolina Electric Membership Corporation
NCEMPA	North Carolina Eastern Municipal Power Agency
N.C.G.A.	North Carolina General Assembly
N.C.G.S.	North Carolina General Statutes
NCHFA	North Carolina Housing Finance Agency
NCMPA1	North Carolina Municipal Power Agency Number 1
NCSU	North Carolina State University
NCUC	North Carolina Utilities Commission
RECS	Residential Energy Consumption Survey
REPS	North Carolina Renewable Energy and Energy Efficiency Portfolio Standard
RESNET	Residential Energy Services Network
SFR	Single Family Rehabilitation Program
SSH	Scattered Site Housing Program
US / U.S.	United States
U.S.C.	United States Code
USGBC	United States Green Building Council

## INTRODUCTION

The cost of living and affordable housing are concerns for many homeowners in North Carolina. Approximately one-third of the homeowners and half of the renters in the state spend more than 30% of household income on housing costs (U.S. Census ACS, 2009-2011c), including mortgage and rental payments, taxes and fees, and utilities (U.S. Census, 2013a). Housing costs that exceed 30% of household income are not considered affordable (U.S. HUD CPD, n.d.a), and North Carolina ranks in the top third of states in the country in the ratio of non-affordable housing costs (U.S. Census ACS, 2009-2011c). Coupled with the increasing electric utility rates in North Carolina, costs associated with home energy consumption are becoming a larger portion of housing costs. Thus, the ratio of affordable housing is decreasing across the state. Internal temperature control for space heating and cooling contributes to almost half of residential energy use in the United States (U.S. DOE EIA, 2013o). Energy efficiency can be a low priority for some homeowners, depending on housing conditions and cost of other living necessities such as food and healthcare. Furthermore, some homeowners, especially low-income homeowners, do not have the financial resources to renovate their homes to be more energy efficient. Therefore, when homeowners have housing needs that they cannot accomplish on their own, they rely on financial assistance, which can come from governmental sources.

One such agency that provides federal housing assistance is the United States Department of Housing and Urban Development (HUD). HUD is the largest provider of housing rehabilitation funding in North Carolina. Two of the programs that support HUD's

mission “to create strong, sustainable, inclusive communities and quality affordable homes for all” (U.S. HUD, n.d.a) and that are the focus of this project are the Community Development Block Grant (CDBG) and HOME Investment Partnerships (HOME) programs. Federal regulations outline the guidelines and requirements for these assistance programs. Partially due to federal funding constraints and deadlines, energy efficiency is not typically the primary objective when housing rehabilitation assistance is involved. For example, while it is a requirement to report to HUD the number of ENERGY STAR housing units constructed with HOME and CDBG funds (U.S. HUD PD&R, 2006), it is not an agency requirement to implement the ENERGY STAR standards in the programs (U.S. HUD PD&R, 2008). In addition, budgets passed by the North Carolina General Assembly in recent years created restrictions on the North Carolina CDBG program that limit the program’s ability to address affordable housing needs in the state (COSCDA, 2013; N.C. Session Law 2013-360, 2013; N.C. Session Law 2013-363, 2013).

To see how the HUD-funded programs can adequately meet the needs of low-income households in the state, this project investigates and analyzes opportunities for program improvements that would prioritize energy efficiency measures. The goals of this research are to: (1) examine if the homeowner needs of energy efficiency match the priorities of HUD-funded housing rehabilitation assistance programs in the state to discover if any redundancies or gaps in administration exist, and (2) investigate the process of integrating energy efficiency and conservation into the HUD programs and make recommendations to

modify program administration for the next 5-year plan to ensure that the needs of low-income homeowners are being met.

### **Objectives**

To meet project goals, developed objectives are to:

1. Compare funding objectives and eligibility criteria of the Community Development Block Grant (CDBG) and HOME Investment Partnerships (HOME) programs funded by the United States Department of Housing and Urban Development (HUD);
2. Identify current baseline energy and electricity characteristics of the residential sector in North Carolina;
3. Identify the state's baseline household demographics and housing characteristics;
4. Identify examples of federal and state policies and standards that successfully integrate residential energy efficiency;
5. Identify HUD's energy efficiency policies; and
6. Compare the energy efficiency priorities of the two federally funded housing rehabilitation programs since the start of the state's current 2011-2015 plan.

### **Methods**

Most of the data needed to accomplish project objectives involve examination of public documents and data from government agencies. It is noted here that while many of the federal and state sources consulted during this investigation do not specify when the particular websites were last updated, program documents provided on those sites tend to be

dated. Therefore, the information obtained for this investigation is current at the time of writing.

To investigate the funding objectives and eligibility criteria of the CDBG and HOME programs funded by HUD, the program regulations, guidelines, action plans, and reports are obtained. Using the information obtained, selection criteria thresholds of program beneficiaries, and overall goals of the two programs are identified and compared. Comparisons consist of program objectives and administration, funding availability and distribution, and service population.

Next, federal and state data trends are examined to identify baseline energy and electricity characteristics of residential North Carolina. Examples of such characteristics include fuel types, power generation and distribution, residential energy projections, and electricity costs. This information is obtained from the United States Department of Energy (DOE), United States Census Bureau, and residential utility providers in North Carolina.

Since the residential sector is the focus of this research, household demographics and housing characteristics are analyzed. To investigate the housing and demographic characteristics of North Carolina, data sets are obtained from readily available public records such as the U.S. Census American Community Survey (ACS). Such data sets include degree of economic distress, income and degree of poverty, population, and age of and type of housing structures. Data is presented at the county level to illustrate differences and similarities across geographical areas and because the county level is the lowest common scope presented among the various sources.

Identification of examples of federal and state policies and standards that promote and successfully integrate residential energy efficiency involves investigation of public records as well. Policies include energy legislation, while standards are more specific to the residential sector. Recognition of these policies and residential energy trends, especially those enacted within the last decade, will lead to identification of financial resources available to homeowners in North Carolina for housing energy assistance.

Next, HUD policies at the federal level are examined further with a specific focus on residential energy efficiency. Again, this data comes from readily available public program reports and assessments. The programs are compared for residential energy efficient goals, strategies, implementation, and accomplishments. Then, the CDBG and HOME programs are compared at the state level, with a specific focus on identifying policies and standards related to residential energy efficiency. Existing residential energy efficient program elements are compared to program areas that lack energy efficient elements.

Finally, based on the identified energy characteristics, housing characteristics, federal and state policies, and energy efficiency priorities, the two programs are evaluated for successfully combining the administration of the program objectives with implementation of energy efficient housing standards. For program elements that do not provide cost-effective energy efficient housing standards, recommendations are made to modify program administration for the state's upcoming 2016-2020 plan.

## **SELECTED HOUSING AND URBAN DEVELOPMENT PROGRAMS**

The focus of this project are the Community Development Block Grant (CDBG) and HOME Investment Partnerships (HOME) programs. These two programs support the charge of United States Department of Housing and Urban Development (HUD) to enhance quality housing and economic opportunities for communities across the country. Both programs are part of the annual ‘formula’ grant provided to states and local units of governments to address community and economic development needs. The four formula grant programs are CDBG, HOME, Emergency Solutions Grants (ESG), and Housing Opportunities for Persons with AIDS (HOPWA) (U.S. HUD CPD, n.d.d). This study does not consider the latter two programs. In accordance with the first objective of this study, comparisons of the CDBG and HOME program discussed in this section are summarized in Table 1.

HUD distributes the formula grants to entitlement and non-entitlement communities. Entitlement communities are metropolitan cities and areas with population over 50,000, and urban counties with populations 200,000 or more (U.S. HUD CPD, n.d.b). Non-entitlement communities are cities with populations less than 50,000 persons or counties with populations less than 200,000 persons (U.S. HUD CPD, n.d.b). North Carolina has 3 entitlement counties and 23 entitlement municipalities (U.S. HUD, n.d.b).

Entitlement communities receive 70% of the annual CDBG formula funding assistance, while states and non-entitlement communities receive 30% of the annual allocation (U.S. HUD CPD, n.d.b). Entitlement communities receive 60% of the annual HOME formula funding assistance, while states and non-entitlement communities receive

40% of the annual allocation. States are eligible to receive \$3 million of HOME funds or their formula allocation, whichever is greater (U.S. HUD, 2011).

### **Program Authority and Purpose**

Since the enactment of the Housing and Community Development Act (HCDA) of 1974, the CDBG program has provided funding assistance to units of local government to address community development needs. The mission of the CDBG program is to provide “decent housing and a suitable living environment and expanding economic opportunities, principally for persons of low and moderate income” (42 U.S.C. § 69.5301(c), 2010). The national objectives of the State CDBG Program are to (1) benefit low- and moderate- income (LMI) persons, (2) address slum and blight, and (3) meet urgent needs (24 C.F.R. § 570.483, 2004). Low-income persons are defined as members of households with incomes 50-80% below the area median income, which is adjusted annually by HUD, based on census data and number of household members. Seventy percent (70%) of the annual allocation must assist LMI persons and households (24 C.F.R § 570.484, 2004). Generally, CDBG program activities can include housing rehabilitation and reconstruction, installation of water and sewer lines, economic development, assistance to small businesses for job retention and creation, community facilities, and planning for developing local government capacity.

Title II of the Cranston-Gonzalez National Affordable Housing Act of 1990, also known as the HOME Investment Partnerships Act, reaffirmed the nation’s commitment to “decent, safe, sanitary, and affordable housing” (42 U.S.C. § 130.12721, 2010). The HOME Program is the nation’s largest federal grant program provided to local governments for the

purpose of increasing homeownership and affordable housing opportunities for low- and very low- income persons (U.S. HUD CPD, n.d.f).

### **Program Administration and Reporting**

The state and entitlement grantees that receive the four HUD formula funding streams are required to collaborate and submit a Consolidated Plan (24 C.F.R. § 91, 2004; U.S. HUD CPD, n.d.d). North Carolina's Consolidated Plan outlines the state's formula grant priorities over a five-year period. The North Carolina Housing Finance Agency (NCHFA) administers the HOME Program (U.S. HUD CPD, n.d.f), while the North Carolina Department of Commerce manages the CDBG program. The North Carolina Department of Health and Human Services (DHHS) administers the ESG and HOPWA programs. These Consolidated Plan partner agencies are charged with the distribution and administration of federal formula funds from HUD to local governments in non-entitlement areas. The state agency partners are currently in the 2011-2015 Consolidated Plan period to provide decent housing, suitable living environments, and expanding economic opportunities across the North Carolina per HUD requirements (N.C. DOC DCA, 2013b).

The 1981 amendments to HCDA allowed states to administer the CDBG program for non-entitlement areas. In North Carolina, the Division of Community Assistance (DCA) and Commerce Finance Center (CFC) within the North Carolina Department of Commerce jointly administered the State CDBG program (N.C. DOC DCA, 2013a; N.C. DOC, 2013). HUD authorizes "maximum feasible deference" at 24 C.F.R § 570.480 to the State CDBG program, which allows the state flexibility in determining how to administer the HUD

program, distribute funding, and monitor grantee compliance, as long as HUD requirements are adequately met and state program standards are not inconsistent with the HUD statutes. The purpose of maximum feasible deference is to allow each state to determine how to best address community needs and meet HUD requirements. As a condition of receiving HUD funds and to help administer the grant program, the state must provide a 2% match for each annual allocation (24 C.F.R § 570.489, 2004). Additional technical assistance funding is allowed as well, up to 1% of the annual HUD allocation. North Carolina is the only state in the country that does not operate the program with a cash match. Instead, North Carolina operates the program through an in-kind match of staff hours with the State Planning Office within DCA (COSFDA, 2013).

The 1995 amendments to HCDA require the partner agencies to submit two annual reports to HUD (24 C.F.R. § 91, 2004). DCA is the lead entity in compiling reporting data to HUD. The reports illustrate the Consolidated Plan partner agencies' compliance with federal national objectives and the adopted Consolidated Plan (N.C. DOC DCA, 2013b). The annual reports describe funding distribution methodology and types of beneficiaries assisted with the federal funds. Every November, the partner agencies submit the Annual Action Plan (AAP) with proposed activities and expected outcomes for the following funding cycle (N.C. DOC DCA, 2013b). Every March, the partner agencies submit the Consolidated Annual Performance and Evaluation Report (CAPER), which illustrates performance outcomes accomplished in the previous funding year. These two annual reports require public notification and a public comment process to ensure community involvement and input into

the state's distribution and performance outcomes of funds. The Consolidated Plan partners also have annual audit reports required by the North Carolina government. In addition, the DCA and CFC submit an annual report in September to the North Carolina General Assembly. This report describes awards made with CDBG funds during the State's previous fiscal year (from July 1 to June 30). All of these reports assist local and federal decision-makers in evaluating program implementation (N.C. DOC DCA, 2013b). With the submission of each updated report, including the 2016-2020 Consolidated Plan, an opportunity for change emerges through the required citizen participation process.

### **Program Funding Allocations**

According to the 2010 United States Census, North Carolina is the 10<sup>th</sup> most populous state (U.S. Census, 2013b). With the rural population at 3.2 million persons, North Carolina has the nation's 2<sup>nd</sup> second highest rural population and 15<sup>th</sup> highest percent of the population in rural areas (U.S. Census, 2013b). Due to persistent poverty, economic distress, and the need for assistance, North Carolina often receives a large annual allocation from HUD (U.S. HUD CPD, n.d.e). Table 2 shows the annual HUD formula grant allocations to North Carolina from 2011 to 2013. In 2012, North Carolina's State CDBG program received approximately \$41 million from HUD, second only to Texas (COSDA, 2013). In 2013, the program received over \$43 million, again, the second highest national allocation (U.S. HUD CPD, n.d.). In both 2012 and 2013, North Carolina's HOME program received over \$12 million, the 10<sup>th</sup> highest allocation in the country (U.S. HUD CPD, 2011; U.S. HUD CPD, 2012).

### **CDBG Housing Rehabilitation Program**

Revealed through the citizen participation process, single-family owner-occupied housing rehabilitation has historically been a priority for North Carolina's CDBG program. LMI households are targeted so the state can meet HUD's primary national objective for the program. North Carolina's *Scattered Site Housing Program* (SSH) provides each eligible county a \$400,000 grant opportunity on a non-competitive basis every three years (N.C. DOC DCA, n.d.). Counties can opt out of receiving the funds, unless an eligible municipality decides to assume the responsibility as the lead local entity for receipt and implementation of the grant funding for that program year. Counties can also elect to apply for competitive funding to supplement the rotational funds. Program activities include housing rehabilitation, clearance and reconstruction (replacement of a home within the same footprint), and emergency/urgent repair. Citizen participation and feedback help determine grantee priorities. Then, the local government creates a scoring system and ranks eligible household recipients by elderly, disabled, and income status. The local government jurisdiction notifies the public of this process, as required by HUD, and attempts to address the worst housing conditions of the most distressed populations in the local area (COSFDA, 2013).

North Carolina's CDBG-SSH program focuses on improving conditions of low- and very low-income households. Households with incomes below 50% of the area's median income are eligible for priority listing. In 2011, \$13.2 million of the \$41 million HUD allocation was made available for the SSH program (N.C. DOC DCA, 2011). Thirty-three

(33) counties were eligible to receive \$400,000 each. In 2012, the N.C. General Assembly budget allowed approximately \$7 million for the SSH program, so the thirty-one eligible counties each only received \$225,000 that year (N.C. DOC DCA, 2012).

The eligible CDBG-SSH activities have different cost thresholds. Emergency repairs are limited to \$5,000 per housing unit. Substantial rehabilitation is classified as over \$40,000, or \$38 per square foot, including lead-based paint abatement costs (N.C. DOC DCA, 2012). Reconstruction can cost close to \$120,000 per house, depending on the area and environmental conditions. Per 24 C.F.R. § 35 and N.C. General Statutes Chapter 130A, all grantees are required to test homes built 1978 or earlier for lead-based paint and mitigate any hazards to the occupants of the home (N.C. DOC DCA, 2012). Any housing rehabilitation needs to comply with the current state building code. Manufactured homes need to meet HUD standards, and modular homes need to meet local building codes.

### **HOME Housing Rehabilitation Program**

In accordance with national HOME program objectives, the mission of NCHFA is to provide affordable housing opportunities for the local community (NCHFA, n.d.a). Through the public notice process, area residents can apply for assistance for housing rehabilitation. Potential program beneficiaries are selected by criteria established through the public notification and input process. NCHFA has a very similar process in distributing HOME grant funds through its *Single Family Rehabilitation* (SFR) program (NCHFA, n.d.b). Local jurisdictions are eligible for HOME-SFR funding on a rotational basis. Households with incomes below 80% of the area's median income are eligible for priority listing. Unlike the

CDBG-SSH Program, the SFR program is designed for *moderate* rehabilitation of homes, capped at \$45,000 per unit. SFR is *not* the program to address urgent need, substantial rehabilitation, or housing replacement. In 2011, \$5.91 million (42% of the annual allocation) was utilized to rehabilitate 130 homes (N.C. DOC Consolidated Plan Partners, 2012). In 2012, close to \$5 million (24% of the annual allocation) was expended to provide housing rehabilitation to 221 homes (N.C. DOC Consolidated Plan Partners, 2013).

## **ENERGY BASICS**

As part of the first goal of this study, to examine homeowner needs of energy efficiency, energy concepts need an introduction. Energy efficiency and energy conservation are partner concepts in the goal of reducing energy consumption. Energy efficiency is using less energy to achieve the same result, while energy conservation is a reduction in energy as a result of a certain behavior change (U.S. DOE EIA, 2013o). Prior to changing any behaviors to conserve energy, consumers and policy makers need adequate information to make decisions. To evaluate energy consumption, customers must understand the types and sources of energy, how it is provided, what entities provide it, how it is utilized, how much it costs, and the quality of data available (e.g, utility bill history) (Mull, 2012). These factors are explored in this project to meet the second project objective of identifying baseline energy and electricity characteristics of residential North Carolina. Because the Energy Information Administration (EIA) within the United States Department of Energy (DOE) is charged with publishing and analyzing monthly energy and electricity data for the country, much of the energy data is retrieved from the EIA.

### **Primary Energy Sources and Utilization**

Primary energy sources are used to generate electricity (U.S. DOE EIA, 2013e). The major sources of primary energy fuels are petroleum, coal, natural gas, nuclear, and renewables. These sources are consumed amongst the residential, commercial, industrial, and transportation sectors (U.S. DOE EIA, 2012f).

Coal is the largest primary energy source for North Carolina. In 2011, the state ranked 12th in the nation for coal consumption at 624.8 trillion Btu (U.S. DOE EIA, 2013m). Compared to national percentages, in 2011, N.C. had similar energy use in the transportation sector, higher use in the residential sector, and lower use in the industrial sector (U.S. DOE EIA, 2012c). When compared to other states, N.C. ranks 12<sup>th</sup> in the nation in overall energy consumption and 10<sup>th</sup> in residential energy consumption (U.S. DOE EIA, 2013l).

Because energy and electricity are provided by a variety of sources, a common unit of measurement is needed for consumer understanding of consumption. The typical residential utility bill shows consumption of electricity in terms of in kilowatt-hours (kWh) and natural gas utilization measured in therms. To compare energy consumption, both units can be converted to the British Thermal unit (Btu). A kilowatt-hour is 1,000 watts of power used for one hour. One kilowatt-hour of electricity is equal to 3,413 Btu. One therm of natural gas is equal to 100,000 Btu. The EIA generally presents energy data in Btu (U.S. DOE EIA, 2013e).

### **Electricity Generation**

Electricity is considered a secondary energy source because a primary energy source has to be converted into a usable form (U.S. DOE EIA, 2013p). It takes three times as much primary energy to generate electric power (U.S. DOE EIA, 2013c). In both 2010 and 2011, about 40% of primary energy in the United States was used to generate electricity (U.S. DOE EIA, 2011c; U.S. DOE EIA, 2012f). Approximately 63% of the energy used to create electricity is lost in conversion (U.S. DOE EIA, 2011c; U.S. DOE EIA, 2012f).

As illustrated in Figure 1, the primary energy sources to generate electricity come from coal-fired plants, natural gas plants, nuclear plants, and renewable energy such as hydroelectric power (U.S. DOE EIA, 2011c; U.S. DOE EIA, 2012e). In 2010, the fossil fuels, coal and natural gas, dominated the primary energy sources used to generate electricity (U.S. DOE EIA, 2011c; U.S. DOE EIA, 2012a). Coal produced about 45% of the country's electricity generation and approximately 56% of North Carolina's electricity generation. Because the state does not have coal deposits as a natural resource, it imports coal from other areas, namely Kentucky and West Virginia (U.S. DOE EIA, 2012c). North Carolina has little electricity generated from natural gas, whereas nuclear power generated a third of the state's electricity (U.S. DOE EIA, 2012a). The state ranks 5<sup>th</sup> nationally in production of nuclear energy for electricity consumption (U.S. DOE EIA, 2012c).

## **RESIDENTIAL ENERGY AND ELECTRICITY**

To examine the HUD-funded programs and energy conservation for communities, a better understanding of North Carolina's overall energy profile is needed. The EIA has conducted the Residential Energy Consumption Survey (RECS) periodically since 1978 to document residential housing energy characteristics (U.S. DOE EIA, 2011a). Nationally, electric power and natural gas power dominate in providing energy to the residential. According to the 2009 RECS, approximately 46% of home energy is powered by natural gas and 43% is powered by electricity (U.S. DOE EIA, 2012f). In 2009, energy consumption of North Carolina's residential sector was comprised of 62% electricity and 22% natural gas (U.S. DOE EIA, 2013k), slightly higher than in 2007 (ASU, 2010).

Energy provided to homes is divided by the end uses of space heating, space cooling, water heating, and other uses (appliances, electronics, and lighting). Figure 2 shows the RECS from 1978, 1993, 2005, and 2009 (U.S. DOE EIA, 2011b; U.S. DOE EIA, 2013d). Overall, the energy used for residential space heating decreased, while energy for space cooling increased. Energy used for space cooling and water heating increased from 1978 to 2005, but decreased slightly from 2005 to 2009, possibly due to increased utilization of efficient technologies and appliance upgrades (U.S. DOE EIA, 2011b; U.S. DOE EIA, 2013d). In 2009, thermal control for space heating and cooling accounted for 48% of residential energy use in the United States (U.S. DOE EIA, 2013o), similar to North Carolina's usage (ASU, 2010).

The 2009 RECS was the first time since 1978 that space heating was less than half of residential energy consumption. While space heating comprises a smaller proportion of residential use than in previous years presented, it is still the largest end use of home energy on the national and North Carolina levels. This trend can be attributed to utilization of technology that is more efficient, installation of better thermal insulation, tighter building envelopes, and people moving to warmer areas (U.S. DOE EIA, 2013d; ASU, 2010; GDS Associates 2006). Migration of people to warmer areas can potentially lead to less usage of heating and increased usage of cooling thermal controls for residential comfort. Nationally, approximately half of homes use natural gas for heat and about one-third use electricity for heat (U.S. Census ACS, 2009-2011c; U.S. DOE EIA, 2012c; U.S. DOE EIA, 2012f). In North Carolina, about 25% of homes use natural gas from utility providers for heat and 58% of homes use electricity for heat (U.S. Census ACS, 2009-2011c; U.S. DOE EIA, 2012c). Other heating fuel sources include wood, kerosene, and propane tanks. Nationally, North Carolina ranks 45<sup>th</sup> in percentage of homes that use natural gas from utility providers for heat, and 5<sup>th</sup> in percentage of homes that use electricity for heat (U.S. Census ACS, 2009-2011c).

Since 1950, electricity has evolved to be a larger portion of residential energy use (U.S. DOE EIA, 2013d). In 2009, the average United States household used 41 million Btu of electricity, which required 130 million Btu of primary energy (U.S. DOE EIA, 2013e). In 2011, about 37% of the electricity generated powered the U.S. residential sector (U.S. DOE EIA, 2012b). The single largest usage of residential electricity is space cooling at

approximately 20% (U.S. DOE EIA, 2013j). Use of air-conditioning in households increased from 57% in 1980 to 87% in 2009 (U.S. DOE EIA, 2012f). Energy used for appliances, electronics, and lighting increased steadily from 1978 to 2009, likely due to the increasing variety and options of home electronics available to consumers (U.S. DOE EIA, 2011b; U.S. DOE EIA, 2013d). For example, the number of households with three or more televisions increased from 29% in 1997 to 44% in 2009 (U.S. DOE EIA, 2012f). Most notably, the number of households with computers increased from 35% in 1997 to 76% in 2009 (U.S. DOE EIA, 2012f). It is possible that this percentage of household use of electronic devices has increased even more since 2009.

While the number of homes has increased, the average energy use of individual housing units has decreased (U.S. DOE EIA, 2012d). In addition, homes built during 2000-2009 are roughly 30% percent larger than homes built prior to 2000, but only consume an average of about two percent more total energy (U.S. DOE EIA, 2013b). More new homes were constructed more in the South (U.S. DOE EIA, 2013b). Due to the South's hot and humid climate, space cooling is used more and space heating is used less (U.S. DOE EERE, 2010c; U.S. DOE EIA, 2012f). Furthermore, newer homes tend to have more electronic amenities, which contribute to a greater proportion of household energy use than in previous survey years (U.S. DOE EIA, 2013b). Housing structure type is also a factor in comparing energy use. Multi-family units generally use less energy compared to single-family housing units due to common insulating walls and floors and less individual unit exposure to the

elements (U.S. DOE EIA, 2013i). Housing structure comparisons will be discussed in a later section.

### **Energy and Electricity Projections**

EIA's *Annual Energy Outlook 2013* provides projections of national energy use to the year 2040. Different projection tracks are based on current available technology, higher technology, and best available future technology. EIA predicts that even with energy efficiencies, overall electricity demand will grow by 28% from 2011 to 2040 (U.S. DOE EIA, 2013f). EIA projects that coal-fired electric power plants will still dominate total electricity generation in 2040, but by a smaller margin. About 15% of the current active coal-fired plants are expected to retire by 2040 (U.S. DOE EIA, 2013f). By 2040, new electricity generation capacity to meet demand will be comprised of 3% coal, 63% natural gas, 31% renewables, and 3% nuclear sources. This new generation pattern can change depending on plant efficiencies, fuel prices, emission restrictions, renewable energy portfolio standards, technology tax credits, and electricity demand growth (U.S. DOE EIA, 2013f).

With efficiency measures and construction improvements, individual household residential energy is estimated to decline 22-42% percent by 2040. In addition, EIA predicts that individual household electricity use will decrease six percent by 2040 with just today's technology (U.S. DOE EIA, 2013f). However, while individual household energy and electricity consumption is anticipated to decline, the number of households is predicted to increase 32% and square footage of households is expected to increase by 41% (U.S. DOE EIA, 2013f). Lighting, heating uses, and increased technology efficiencies contribute to the

decrease in residential energy demand, while space cooling and new household devices contribute to increased residential demand (U.S. DOE EIA, 2013f).

Compared to other regions of the country, the South uses the most residential energy, but individual households consume below the national average per household (U.S. DOE EIA, 2012f). As part of the southeastern region of the country, the mostly mixed to hot and humid climate of North Carolina generally requires buildings to have more cooling mechanisms than heating mechanisms (U.S. DOE EERE, n.d.; U.S. DOE EIA, 2012f). Six counties in the northwest corner of the state are classified as having a colder climate and are likely to operate heating systems more than other counties. Therefore, residential structures in these counties have need for more efficient heating systems than cooling systems (U.S. DOE EERE, 2010c; Hinton, 2012; ICC, 2012). Furthermore, efficiency improvements to heating systems are estimated to contribute the most energy and cost savings to North Carolina's residential sector (ASU, 2010; GDS Associates, 2006). Discussion of direct residential use of natural gas has merit in evaluating overall residential energy. However, more North Carolina homes use more electricity year-round than natural gas. Therefore, because both of the HUD-funded programs featured in this project must meet national objectives to provide quality affordable housing opportunities to low-income households, analyzing electricity is the focus of the residential energy throughout this report.

## **ELECTRICITY PROVIDERS IN NORTH CAROLINA**

As illustrated in Figure 3, electricity in North Carolina is provided by about 100 electric service providers comprised of investor-owned utilities (IOUs), electric cooperatives (EMCs), and municipal publicly-owned utilities (Carolina Country, 2013). In 2011, the EIA reported 3 IOUs, 31 EMCs, and 72 municipal public utilities (U.S. EIA, 2012h; U.S. EIA, 2012i). In 2013, the North Carolina Utilities Commission (NCUC) reported 74 municipal public and university electric providers (NCUC, 2013). These entities collectively generate, transmit, and distribute base load and peak load electric power across the state. Base load power is provided on a continuous basis, while peak load is provided intermittently during periods of high utilization (U.S. DOE EIA, n.d.). IOUs are private companies that individually own and manage power generation plants to provide service directly to customers and wholesale service to other energy providers (Wichman and Hughes, 2011). Electric cooperatives primarily provide electric service to the rural areas of the state, and are owned by members-customers who can elect board members (Wichman and Hughes, 2011). Municipal-owned public power utilities serve primarily as a distributor of electricity to their customers. Both electric cooperatives and public power utilities have purchase agreements with IOUs (Wichman and Hughes, 2011).

The North Carolina Public Utilities Act of 1963 provided authorization to the State's Utilities Commission to regulate "rates, services, and operations" (N.C.G.S., § 62.2(a), 1963) of public utilities to ensure "adequate, reliable and economical" (N.C.G.S., § 62.2(a), 1963) utility access to customers of the State (N.C.G.S., § 62-2, 1963). The NCUC regulates

the IOUs in terms of company practices and consumer rates, but not the electric-cooperatives or municipal public power providers (NCUC, n.d.). The NCUC also processes complaints filed against public utilities if services are “inadequate, insufficient, or unreasonably discriminatory” (N.C.G.S. § 62.42(a)(1), 1965). As of July 2013, the N.C. Rural Electrification Authority handles consumer complaints for the EMCs (N.C. Session Law 2013-187, 2013). To avoid duplication of electric facilities, the NCUC defined service area boundaries for these entities in 1966 (N.C.G.S. §§ 62-110.1-2, 1965). The Commission also regulates construction of certain new transmission lines and facilities that are certified as environmentally compatible public necessities (N.C.G.S. § 62-101, 1991; N.C.G.S. §§ 62-110.1-2, 1965).

As shown in Table 3. *Retail Electricity Providers in North Carolina, 2011*, 67% of electricity sold in North Carolina was sold by IOUs, 21% by electric cooperatives, and 12% by municipal public power (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i). The customer base of each of the electricity providers is about 85-90% residential. Approximately 40% of megawatt hour sales and about 45-49% of dollar revenues for the IOUs and municipal public power come from the residential sector. Meanwhile, the residential sector contributes 74% of electric power sales and 78% of dollar revenues for electric cooperatives (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i).

### **Investor-Owned Utilities**

There are two investor-owned utilities in North Carolina: Duke Energy and Dominion. According to the 2011 EIA data depicted in Table 3, Duke Energy serves the

majority of IOU customers (approximately 96%), of which about 85.5% are residential customers (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i).

### **Duke Energy**

Prior to 2012, Progress Energy was a separate investor-owned utility. In July of 2012, Progress Energy became a wholly owned subsidiary of Duke Energy when the companies merged (Duke Energy Corporation, 2012). Progress Energy still has central operations in Raleigh, but under the new company name- Duke Energy Progress. Duke Energy Carolinas serves about 40 counties in the western Piedmont (Duke Energy Corporation, n.d.j), with operational headquarters in Charlotte, North Carolina. Acquisition of Progress Energy expanded Duke Energy's service area to about 90 of the state's 100 counties (Duke Energy Corporation, 2011; Carolina Country, 2013).

The merger of Progress Energy and Duke Energy created the largest electric utility provider in the nation, providing electricity to approximately 7.2 million customers in six states (Duke Energy Corporation, 2011). While the companies are merged, Duke Energy Progress and Duke Energy Carolinas operate separately. Therefore, the data available from the EIA is presented separately. According to the EIA, in 2011, Duke Energy Carolinas had 1.6 million residential customers and Progress Energy had about 1.08 million residential customers (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i). In 2012, Duke Energy Carolinas and Duke Energy Progress collectively served 3.9 million customers across the state (Duke Energy Corporation, 2013b).

Duke Energy generates approximately 49,700 megawatts (MW) of electricity to serve its 7.2 million customers (Duke Energy Corporation, n.d.d). The utility's six nuclear power plants (Duke Energy Corporation, n.d.h) and nine coal-fired plants in the Carolinas (Duke Energy Corporation, n.d.c) generate roughly 20,000 MW. Oil/gas fired and hydroelectric plants are used intermittently for peak loads (Duke Energy Corporation, n.d.d). Some of Duke Energy's power plants constructed in the 1970s and 1980s have shared ownership with other electric utilities in the state. Appendix A contains information about these specific power plants.

### **Dominion Resources**

Virginia Electric and Power Company rebranded as Dominion Resources, Inc. in 2000 (Dominion Resources, 2013c). With corporate headquarters in Richmond, Virginia, the utility serves nearly six million customers in 15 states (Dominion Resources, 2013a). A branch of the corporation, Dominion North Carolina, provides electric service to about 120,000 customers in the state's 17 northeastern counties (Carolina Country, 2013; Dominion Resources, 2013a), 85% of which are residential customers (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i).

Dominion operates 27,500 megawatts of generation (Dominion Resources, 2013a), the majority of which comes from coal and natural gas (Dominion Resources, 2013b).

Dominion North Carolina has three power stations for electricity generation in the state:

Rosemary Power Station, Gaston Hydro Station, and Roanoke Rapids Power Station.

Rosemary Power Station, located in Roanoke Rapids, primarily uses natural gas to generate

165 MW of electricity for approximately 41,000 homes (Dominion Resources, 2013f). The Gaston Hydro Station (Dominion Resources, 2013d) and Roanoke Rapids Power Station (Dominion Resources, 2013e) produce hydroelectric power from Lake Gaston (220 MW) and Roanoke Rapids (95 MW), respectively.

### **Electric Cooperatives**

Electric cooperatives (EMCs) are non-profit utility providers for rural North Carolina (Wichman and Hughes, 2011). Customers are considered members and elect the board members. Twenty-six (26) electric cooperatives serve in ninety-three (93) of 100 counties in the state and form the N.C. Electric Membership Corporation (NCEMC), based in Raleigh (North Carolina Electric Cooperatives, n.d.c). Five other electric cooperatives based in neighboring states also serve North Carolina customers (U.S. DOE EIA, 2012i). Most of the EMCs are also part of Touchstone Energy, the national alliance of 700 electric cooperatives in 46 states (North Carolina Electric Cooperatives, n.d.b). Out of approximately 2.5 million customers, close to one million are residential (North Carolina Electric Cooperatives, n.d.c). The electric cooperatives work together for the generation and transmission of power, purchase contracts, marketing and research, and publication and distribution of *Carolina Country Magazine* to subscribing members (North Carolina Electric Cooperatives, n.d.c).

The NCEMC has approximately 62% ownership interest of Unit 1 of the Catawba Nuclear Station. Duke Energy owns the remainder, and operates the station. NCEMC receives base load electric power from the nuclear station. Peak load electricity comes from

two oil generators in the Outer Banks, purchase agreements with investor-owned utilities, and natural gas plants (North Carolina Electric Cooperatives, n.d.a).

### **Municipal Public Power**

Municipal public power utilities in North Carolina act as distributors of electricity via power purchase agreements with the IOUs (Wichman and Hughes, 2011). Seventy-two (72) of the public power utilities are municipal owned and operated electric providers, while another seven (7) are university systems (U.S. DOE EIA, 2012i; Carolina County, 2013). Fifty-one (51) of these entities are affiliated with one of the two Power Agencies. Nineteen (19) of these entities are members of and 32 entities are members of North Carolina Eastern Municipal Power Agency (NCEMPA) (ElectriCities, 2012a). NCEMPA1, formed in 1976, represents members of the western part of the state and NCEMPA, formed in 1982 (ElectriCities, 2012c), represents the eastern part of the state (ElectriCities, 2012a). Both Power Agencies operate with a board of directors and are members of ElectriCities.

Founded in 1965 and centered in Raleigh, ElectriCities provides administrative services such as governmental and legal affairs, marketing and communications, emergency assistance, customer service, employee training, and technical assistance (ElectriCities, 2011a). In addition to the 51 entities affiliated with a Power Agency, the 2012 Annual Report for ElectriCities also lists 14 members not affiliated with a Power Agency and 17 members outside North Carolina (ElectriCities, 2011b). The remaining 14 public power entities, not members of ElectriCities, are either university-owned, independent, or listed as purchasing whole electricity from members of ElectriCities.

In 2011, municipal public power accounted for about 12% of all retail electric sales in the state (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i). Approximately 587,000 customers were served by a public power utility, about 85% of which were residential customers (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i).

North Carolina Municipal Power Agency Number 1 (NCMPA1) has 75% ownership of Unit 2 at the Catawba Nuclear Station. Other power for NCMPA1 customers is provided through supplemental electric power agreements with Duke Energy's McGuire Nuclear Plant in Mecklenburg County and smaller merchant generators. Periods of peak demand are powered by approximately 35 city and individual end-user diesel generators, and two natural gas turbines (ElectriCities, 2012a).

North Carolina Eastern Municipal Power Agency (NCEMPA) owns portions of two nuclear and two coal-fired electric power plants with Duke Progress Energy (ElectriCities, 2012a). Once received by Duke Energy, the power generated at these plants is distributed by the municipality. When the above power is not sufficient to meet community needs, the member municipalities purchase additional power from investor-owned utilities and federal hydroelectric facilities (ElectriCities, 2012c). Because the retail electricity providers across the state have different territories, consumer costs can vary across the state as well.

## **RESIDENTIAL ELECTRICITY COSTS IN NORTH CAROLINA**

Now that providers of electricity are established, costs of the electric power need to be evaluated. Average monthly electricity indicators from the EIA data are compiled in Table 4 (U.S. DOE EIA, 2012g). In 2011, North Carolina residents paid more per kilowatt-hour than consumers in the commercial and industrial sectors. While the state's 2011 residential average cost of 10.26 cents per kilowatt-hour was lower than the national average, households used more electricity and therefore, average monthly bills were higher than the national average. As illustrated in Table 3, in 2011, residential customers of the three investor-owned utilities customers paid an average of 9.50 cents/kWh. Residential customers of the state's electric cooperatives and public power utilities paid an average of 12.01 cents/kWh and 12.62 cents/kWh, respectively (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i). In July 2013, the state ranked 36<sup>th</sup> in the nation with the increase of the state's average residential price of electricity to 11.17 cents/kWh (U.S. DOE EIA, 2013n). It is important to note here that the kWh usage only represents a portion of how residential utility bill costs are calculated. In addition to cost of consumption (cents/kWh) during the billing cycle, residential utility bills also include base rates for facilities charges (Dominion Resources, 2013g; Duke Energy Corporation 2013c; Duke Energy Corporation 2013d). Residents should review details of their monthly utility bills charges as part of comprehensive understanding of home energy costs.

**Duke Energy**

Although the companies merged, Duke Energy Progress is a subsidiary and operates separately from Duke Energy Carolinas. Therefore, the utilities can have separate sets of electric rates. In 2011, prior to the merger, the average retail price for Duke Energy was 7.53 cents/kWh (9.15 cents/kWh for residential customers). The average price for Progress Energy Carolinas in 2011 was 8.66 cents/kWh (10.12 cents/kWh for residential customers) (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i).

In October 2012, Duke Energy Progress applied for customer electric rate increases (Duke Energy Corporation, 2013a). As of June 2013, residential electric rates will increase 7.5 percent over a two-year period. The new basic residential rate is an average of 10.11 cents/kWh. The rate increase includes the basic electric charge increased from \$6.75 per month to \$11.50 per month (Duke Energy Corporation, 2013c).

In February 2013, Duke Energy Carolinas requested a rate increase. Over a three-year period, residential electric rates will increase approximately ten percent. As of September 2013, the average basic residential price increased from 9.29 cents/kWh to 9.67 cents/kWh and the monthly basic facility charge increased from \$9.90 to \$12.19 per month (Duke Energy Corporation, 2013d).

**Dominion North Carolina**

According to EIA, in 2011, Dominion North Carolina's average price of electricity was 7.20 cents/kWh, compared to the residential rate of 9.22 cents/kWh (U.S. DOE EIA,

2012h; U.S. DOE EIA, 2012i). As of January 2013, the utility's residential rate is an average of 9.8 cents/kWh, with a basic charge of \$11.36 per month (Dominion Resources, 2013g).

### **Electric Cooperatives**

The 2011 prices for the 26 electric cooperatives in North Carolina and the 5 out-of-state electric cooperatives that provide electricity to North Carolinians are captured in Table 3 (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i). The residential electric rates ranged from 9.76 to 14.39 cents/kWh, with average of 12.01 cents/kWh, above the investor-owned utility average rate of 9.50 cents/kWh. As stated previously, the electric cooperatives serve more rural areas of the state, and therefore, a smaller amount of residential customers along distribution lines than utilities serving densely populated areas. In addition, the cooperatives purchase wholesale power from IOUs. Therefore, electric cooperative customer prices are higher than prices of IOUs to satisfy the purchase agreements between electric service providers.

### **Municipal Public Power**

During the energy crisis in the 1970s, the investor-owned utilities and the two Power Agencies in ElectriCities banded together to construct several new power plants, including nuclear plants (ElectriCities, 2012b). In 1977, an amendment to Article V, Section 10 of the North Carolina Constitution allowed municipal power to jointly own power plants with investor-owned utilities (North Carolina Constitution). It was anticipated that the projected increase in electricity demand would allow the 51 municipal power utilities to pay off debt in a reasonable amount of time (ElectriCities, 2012b). However, a partial meltdown at the

Three Mile Island nuclear power plant in Pennsylvania in 1979 contributed to increased interest rates and construction costs of new plants (Stith and Little, 2012). NCEMPA's debt remaining as of December 2012 is \$2.16 billion (ElectriCities, 2012a). Thirty-eight percent (38%) of NCEMPA's wholesale pricing is to cover debt, which is expected to be paid off by 2026 (ElectriCities, 2013). As of December 2012, NCMPA1's debt remaining is \$1.5 billion and expected payoff is in 2031 (ElectriCities, 2012a). Due to this debt, average electric rates for public power customers are greater than those of electric cooperates and investor-owned utilities. As illustrated in Table 3, the residential electric rate for publicly owned utilities averages 12.62 cents/kWh, above the average rates for the electric cooperatives and investor-owned utilities (U.S. DOE EIA, 2012h; U.S. DOE EIA, 2012i). Like electric cooperatives, municipal public power entities have purchase agreements with IOUs. Hence, customer prices are higher than those of IOUs for the IOUs to make profits.

In 2012, the Frank Hawkins Kenan Institute of Private Enterprise at the University of North Carolina at Chapel Hill investigated electricity prices from the ElectriCities Power Agency members NCMPA1 and NCEMPA and the income of residential customers served (Stith and Little, 2012). The state's average residential electric rate in 2009 was 9.9 cents/kWh. Meanwhile, NCPMA1 residential customers paid rates at or slightly higher than the state average, and NCEMPA residential customers paid roughly three cents more per kilowatt-hour. The Kenan Institute also compared these residential electric rates to per capita income of counties, and in general, the lower income areas pay higher rates per kWh (Stith and Little, 2012). The Kenan Institute's research only represents approximately half of the

electric utility providers in the state, but illustrates the need to compare income and cost of electricity and examine other factors such as economic and housing characteristics.

## **ECONOMIC CHARACTERISTICS OF NORTH CAROLINA**

The third project objective is to identify baseline demographic and housing characteristics of North Carolina, specifically since the start of the state's 2011-2015 Consolidated Plan for HUD formula funding. To determine the impact the cost of electricity has on the population, economic trends of customer service areas need to be examined. One of the parameters for establishing community need is the tiered ranking conducted annually by the North Carolina Department of Commerce. The Department ranks the state's counties by using a combination of unemployment rate, median household income, population growth, and poverty values (N.C.G.S. § 143B-437.08, 2006; N.C. DOC, 2011) to promote economic activity in the highly distressed areas. As shown in Figure 4, the 40 most distressed counties are in Tier 1, the next 40 counties are ranked Tier 2, and the 20 least distressed counties are considered Tier 3 (N.C. DOC, 2011). While a 2014 data set for tiered counties is available, the 2011 data set from is used to compare to the 2011 data available from the American Community Survey (ACS) and the EIA.

An additional element in the economic ranking process is designation of counties by the North Carolina Rural Economic Development Center as rural or urban. Figure 5 shows the counties designated as rural and urban, (North Carolina Rural Economic Development Center, 2000-2012). In general, the rural counties and Tier 1 counties had little to no population growth from 2010 to 2012 (United States Department of Agriculture, 2013).

The ACS is a resource that updates socioeconomic characteristics to help policymakers make community and economic development decisions (U.S. Census ACS,

2013). As mentioned previously, two of the indicators of economic distress are income and poverty. As shown in Figures 6 and 7, in 2011, North Carolina counties with lower median household income and higher poverty tended to be Tier 1 and Tier 2 counties (U.S. Census ACS, 2009-2011c; U.S. Census ACS, 2009-2011b). The median household income captured by the ACS is the income over a twelve month period of individual household members fifteen years or older for a particular geographical area (U.S. Census, 2013c). In 2011, nearly two-thirds of the counties in the state had more than 17% of the population living in poverty (U.S. Census ACS, 2009-2011b). Concurrent with the 2000 Census data used in North Carolina's 2011-2015 *Analysis of Impediments to Fair Housing Choice*, the northeastern and southeastern counties generally have a higher percentage of the population living in poverty (Western Economic Services, LLC, 2010).

## **HOUSING CHARACTERISTICS OF NORTH CAROLINA**

Because the CDBG and HOME programs provide housing rehabilitation to low-income households, the next objective of this research is to identify baseline housing and characteristics, which include age, type of structure, and quality of components. Figure 8 illustrates that as of 2011, Tier 2 and Tier 3 counties generally have newer homes (U.S. Census ACS, 2009-2011a). The areas with more new homes tend to be in the metropolitan and urban centers of the state. In addition, counties that are economically distressed generally have a higher percentage of housing structures constructed before 1970 than counties that are less economically distressed (North Carolina Sustainability Energy Association, 2011; U.S. Census ACS, 2009-2011a). This data means that the eligible service areas of the state CDBG and HOME are counties with greater economic distress and older homes.

One of the indicators used to determine economic need across North Carolina is type of housing structures among county housing stock. Nationally, residents of older mobile and manufactured homes spend twice as much per square foot on energy costs than residents of detached single-family homes (U.S. GAO, 2012b). North Carolina ranks sixth in the nation with about 14% of housing stock as mobile homes (U.S. Census ACS, 2009-2011c).

Therefore, this type of housing is highlighted.

### **Mobile and Manufactured Housing**

Mobile homes, manufactured homes, and modular homes are all factory-built homes that contribute to available housing stock across North Carolina. Although commonly used

interchangeably, mobile homes and manufactured homes are not the same. Mobile homes constructed after June 15, 1976 are considered manufactured homes (U.S. HUD, n.d.c). The National Manufactured Housing Construction and Safety Standards Act of 1974 authorized HUD to develop the *Manufactured Home Construction and Safety Standards*, which are codified at 24 C.F.R. § 3280 (U.S. HUD, n.d.d). Like mobile homes, manufactured homes are built in a factory and transported to a site. However, the HUD Standards contain requirements for manufactured homes to be built on a permanent frame for transportation, along with other standards for dimensions, fire safety, body and frame construction, insulation and air quality, and the plumbing, electrical, heating, and cooling systems (24 C.F.R. § 3280, 2004). Modular homes are also built in a factory to be transported to be assembled on site, but are constructed according to the local government building codes where the home will be located (U.S. HUD, n.d.c), just as if the house was site-built as opposed to factory-built.

Grantees of the state CDBG and HOME programs can only serve single-family homes. Both the state's HOME and CDBG housing programs allow grantees to rehabilitate manufactured homes on a case-by-case basis. The homes must be on permanent foundations with permanent utilities. Grantees can elect not to serve this type of housing structure, as long as they notify the public of the policy (NCHFA, 2011b; NCHFA, 2012; NCHFA, 2013). The CDBG housing program has an additional requirement that the manufactured homes must be built after 1978 (N.C. DOC DCA, 2011; N.C. DOC DCA, 2012).

While mobile and manufactured housing are differentiated by age and the HUD standard, the U.S. Census does not distinguish between the two types. Therefore, Census data sets concerning housing structure units combine manufactured and mobile housing into mobile home only. The southeast region of the state, comprised of mostly Tier 1 and Tier 2 counties, has a high percentage (approximately a third) of available housing stock that is mobile homes (U.S. Census ACS, 2009-2011c). According to the EIA 2009 RECS, 60% of the nation's mobile homes are in the mixed-humid and hot-humid climate regions of the South (U.S. DOE EIA, 2013g). As of 2009, the average size of mobile homes in the U.S. is 1,087 square feet. Fifty-one percent (51%) of mobile homes were constructed between 1970 and 1989 and have an average size of slightly less than 1,000 square feet. Approximately 57% of mobile homes use electricity for heat, while only 21% use natural gas for heat (U.S. DOE EIA, 2013g), which corresponds with North Carolina's percentages of heating fuel (U.S. Census ACS, 2009-2011c; U.S. DOE EIA, 2012c). About one-third of mobile homes are classified as poorly insulated; these are generally the smaller sized units. Seventy-five percent (75%) of the units are occupied by household members who make less than \$40,000 annually in income. In addition, the lower income households occupy smaller-sized units (U.S. DOE EIA, 2013g). This data reveals that the lower income households occupy the older, less insulated, less energy-efficient, and smaller mobile and manufactured housing units across the country. Therefore, considering North Carolina's high percentage of mobile and manufactured housing units, it is worth exploring structural deficiencies and energy

inefficiencies of homes, and the resulting disproportionate electricity costs for the low-income populations of the state.

## **ENERGY EFFICIENCY FOR LOW-INCOME HOUSEHOLDS**

The U.S. Census combines mortgage payments, taxes and fees, insurance, and utilities as selected housing costs (U.S. Census, 2013a). The ratio of these costs compared to household income provides entities an idea of the affordability of that home. For housing to be considered affordable, household members should pay less than 30% of income on the aforementioned housing costs (U.S. HUD CPD, n.d.a). According to the 2009-2011 ACS, North Carolina ranks in the top third nationally in ratio of housing costs to household income. About 30% of homeowners nationally and 27% statewide spend more than thirty percent of household income on housing costs, with or without a mortgage (U.S. Census ACS, 2009-2011c). Close to 52% of renters spend more than thirty percent of household income on housing costs.

According to the EIA, the national percentage of household income expended on energy uses has decreased overall in the past few years. However, lower income households in 2012 still spent about twice the percentage on energy use (6%) than higher income households (3%) (U.S. DOE EIA, 2013h). The gap between actual home energy costs and what the household can afford is the *home energy affordability gap* (Fisher, Sheenan, and Colton, 2013). As household income decreases, the gap increases. HUD references this indicator in the department's 2008 study conducted to reduce home energy costs and increase availability of affordable housing stock (U.S. HUD CPD, 2008). It was concluded that rising energy costs are a concern for households, especially low-income households that sometimes have to decide between paying energy bills and other living expenses. The combination of

energy- inefficient housing, low-income, and inability for the low-income households to pay for energy-efficient improvements results in a increased disproportionate energy and housing costs for the low-income population. Therefore, because HUD programs must benefit low-income households, HUD is exploring voluntary residential energy efficiency and conservation incentive programs across its funding streams dispersed to local governments. This national encouragement of energy efficiency and conservation is consequently passed down to North Carolina's HOME and CDBG programs. In addition, other policies and standards promoting energy efficiency can influence program implementation.

## **POLICIES AND STANDARDS FOR RESIDENTIAL ENERGY**

The evolution of policies and standards associated with energy and electricity have an impact on the residential sector and therefore the priorities of affordable housing funding agencies. For example, air quality standards for new and existing power plants influence the costs of producing energy and electricity. As of the fall of 2013, new greenhouse gas emission standards issued by the United States Environmental Protection Agency (EPA) for new natural gas and coal-fired power plants are under public review (U.S. EPA, 2013b). In the case of electricity generation in North Carolina, coal-fired power plants may have a more difficult task in meeting any updated carbon emission standards than nuclear and renewable energy power plants. Costs associated with meeting these standards will likely be passed onto the consumers. To serve the second goal and fourth objective of this project, this section identifies examples and highlights of policies and standards from the past decade that promote and successfully integrate residential energy efficiency and conservation.

### **Policies**

#### **Federal Actions**

During the past decade, the federal government has demonstrated interest in improving energy conservation and energy efficiency measures. The Energy Policy Act of 2005 charged federal agencies, including HUD, to evaluate energy consumption and departmental standards (U.S. DOE EERE, 2010b). The Energy Independence and Security

Act of 2007 enhanced industry standards for appliances and lighting (U.S. EPA, 2013a). The American Recovery and Reinvestment Act of 2009 provided funding for energy reduction programs (U.S. DOE, n.d.). Federal tax credits for installing certain energy efficiency measures in existing residential homes expired in December 2013 (ENERGY STAR, n.d.b; NCSU DSIRE, 2012-2013a). Renewable energy tax credits for new and existing homes expire in December 2016 (NCSU DSIRE, 2012-2013b).

An example of a federal program focused on reducing energy usage and costs is the DOE Weatherization Assistance Program (WAP). In North Carolina, the State Energy Office administers WAP (N.C. DENR, 2013). While this project focuses on the HUD programs, the WAP funding assistance is important to mention. Nationally, the WAP has been successful in providing approximately 7 million low-income households with energy saving technologies since 1976 (U.S. DOE EERE, 2012a). Priority assistance is for households with members that are elderly, disabled, or children, or households with high residential energy use (10 C.F.R. § 440.16, 2011). In addition, eligible households are those with incomes at or below 200% of the federal poverty level (10 C.F.R. § 440.2, 2011; N.C. DENR, 2013). However, only an average of \$6,500 can be spent on individual units (10 C.F.R. § 440.18, 2011; U.S. DOE EERE, 2012b) and major repairs and rehabilitation are not eligible uses of funds (N.C. DENR, 2013). For households that cannot to afford to make energy efficient improvements, members will need to evaluate if the WAP program would be a viable alternative for their energy reduction needs. If structural deterioration of the home is too great, the WAP program may not be a suitable use of federal funds. It is important to

note that while the WAP program focuses on energy-saving and cost-saving improvements, the CDBG and HOME programs prioritize comprehensive housing rehabilitation.

### **North Carolina Actions**

North Carolina also has examples of policies and standards that promote and integrate energy efficiency in housing. Implemented in 2007, North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard (REPS) requires investor-owned utilities to generate 12.5% of energy from renewable energy sources by 2021 and rural and municipal utilities to generate 10% by 2018 (NCSU DSIRE, 2012). Reasons for adopting such a portfolio vary, including the development of environmentally sustainable resources, reducing environmental impacts, meeting incremental demand with small-sized renewable facilities, and enhancing local economic development (La Capra Associates, et. al., 2006).

The Governor authorizes the state's Building Code Council to adopt building codes. After a three-year process, the 2012 North Carolina Energy Conservation Code (NCEC) became effective in January in 2012 (Hinton, 2012). Modeled after the 2009 International Energy Conservation Code (IECC), the Council's goal was to develop and adopt an energy code that was 30% more energy efficient than the 2006 IECC. Specifications for commercial buildings are 30% more efficient, while mandatory specifications for residential buildings are only 15% more efficient. However, the Appendix of the NCEC includes a set of voluntary 30% more efficient specifications (Hinton, 2012). In addition, each of the three climate zones in the state has a set of prescribed standards in regards to energy efficiency (U.S. DOE EERE, 2010c; Hinton, 2012). The NCEC describes building materials and has schematic

illustrations with measurements for the different heating, cooling, lighting, and water heating systems as well as the building envelope (ICC, 2012). The building envelope is comprised of the parts of the physical structure (i.e., roof, walls, foundation, windows, and doors) that create a barrier between the interior conditioned space and exterior non-conditioned space (U.S. DOE EERE, 2013b). Local government inspectors ensure compliance as part of issuing building permits, while the Office of the Fire Marshall within the N.C. Department of Insurance ensures code enforcement at the state level (Hinton, 2012).

In 2013, the North Carolina *Tax Simplification and Reduction Act* (N.C. Session Law 2013-316, 2013) eliminated the tax credit for consumer purchases of ENERGY STAR appliances such as air conditioners, ceiling fans, and programmable thermostats that had been in effect since 2008 (N.C.G.S. § 105-164.13D, 2008). The Act also combined the tax rate for sale of electricity and piped natural gas to be effective in July 2014 (Tarleton, 2013).

## **Building Standards and Ratings**

### **Manufactured Housing Standards**

While site-built homes must meet local and state building codes, manufactured home codes are prescribed by HUD. The Energy Independence and Security Act of 2007 charged the DOE to set standards for manufactured housing by 2011 (EISA, 2007), but that action has not been accomplished. The DOE was required to consult with HUD, then establish standards based on the IECC unless the standards were not cost effective compared to the

lifecycle costs of manufactured homes. In 2010, DOE requested public comment regarding such standards, particularly for building and design specifications, financing, energy efficiencies, enforcement mechanisms, and relationship to existing IECC and HUD residential energy standards (U.S. DOE EERE, 2010a). As of this writing, standards are still in the public review process (U.S. DOE EERE, 2013a).

### **Energy Star**

Established in 1992, ENERGY STAR is a partnership between the EPA and DOE (ENERGY STAR, n.d.a). This voluntary program promotes reduction in energy consumption via energy efficiency standards for products and buildings. Educating consumers and businesses about the program is crucial to meet the goals of improving the economy, increasing energy security, and decreasing pollution that contributes to global climate change. Between 2000 and 2012, approximately 1.4 million new homes were constructed with ENERGY STAR standards across the county (U.S. EPA, 2014).

Since 2002, the *Home Performance with ENERGY STAR* (HPwES) standard has been available. As of 2013, approximately 336,000 homes nationally have been retrofitted with HPwES standards (ENERGY STAR, n.d.c; U.S. EPA, 2014). HPwES evaluates the entire house in terms of air quality, insulation, heating and cooling systems, windows, lighting, and appliances (ENERGY STAR, n.d.d). Since 2011, the DOE and EPA have partnered with local sponsors to coordinate local HPwES programs (ENERGY STAR, n.d.a). Currently, Advanced Energy, a non-profit organization based in Raleigh, is the only HPwES sponsor in North Carolina that can provide the training and manage quality control for the program.

About a dozen companies are eligible to conduct HPwES standards in North Carolina under Advanced Energy's sponsorship (Advanced Energy, 2011). Along with several municipalities, Advanced Energy collaborates with the North Carolina Housing Finance Agency. NCHFA often partners with non-profit and governmental entities in developing affordable housing and supporting homeownership. The HPwES program with Advanced Energy and NCHFA is discussed in greater detail in a later section.

### **Home Energy Rating System**

The Home Energy Rating System (HERS) Index by the Residential Energy Services Network (RESNET) has become a nationally recognized standard to assess energy utilization of new and existing homes (RESNET, 2013a). RESNET established these standards to provide a framework to compare the energy integrity of homes for consumers and other decision-makers in the housing market. RESNET provides certification programs to HERS raters, who conduct various tests on homes to assess factors such as heat exchange and air movement (RESNET, 2013b). The HERS rating index is similar to the HPwES program. As of 2014, approximately 30 providers are listed in North Carolina to conduct HERS ratings (RESNET, 2014).

### **Leadership in Energy and Environmental Design**

Another national building energy rating system is Leadership in Energy and Environmental Design (LEED). Founded in 1993, the non-profit United States Green Building Council (USGBC) launched the LEED rating system in 2000 (USGBC, 2014b). Developed and routinely updated by field experts, the LEED rating system can be applied to

all building types (USGBC, 2014a), including gut-rehabilitation of existing homes. Points earned in various categories are totaled to determine the classification level of LEED certification. The primary categories are site impact, water efficiency, energy performance, use of materials and resources, and indoor environmental quality. Depending on the building type, additional points are available in categories for considering local transportation opportunities and innovative building operations.

### ***SystemVision***

Low-income homebuyers in North Carolina have access to another home energy evaluation system. In addition to the aforementioned HPwES program, Advanced Energy and NCHFA collaborate in implementing the *SystemVision*<sup>TM</sup> program. In NCHFA's 2011 Self-Help Loan Pool program, recipients financed development of new homes and rehabilitation of vacant or foreclosed homes built after 1978 (NCHFA, 2011a). NCHFA provides gap financing to developers of affordable single-family homes to incorporate targeted energy efficient construction standards identified by Advanced Energy (NCHFA, n.d.c). Building contractors and construction workers are trained in the *SystemVision*<sup>TM</sup> standards. After construction, the homes are available for purchase by low-income homebuyers with household income at or below 80% of the area median income (NCHFA, 2011a). Advanced Energy then provides a guaranteed utility bill amount for two years and a temperature comfort level to the homeowner (Advanced Energy, n.d.). Since 2001, more than 3,000 homes have been certified through the *SystemVision*<sup>TM</sup> program.

## **U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT ENERGY EFFICIENCY STRATEGIES**

Identification of some policies and standards that support residential energy efficiency leads to identification of some examples of financial resources to implement residential energy efficiency projects. Examples of such funding sources are in Table 5, provided in HUD's report to enhance green building design and energy efficiency in certain programs (U.S. HUD PD&R, 2011). Each funding source comes with a set of eligibility criteria and outcome requirements. The second goal of this project is to investigate the process of integrating residential energy efficiency and conservation in North Carolina CDBG and HOME programs. Because HUD provides federal funding for the CDBG and HOME programs, the policies that influence residential energy efficiency are examined at the federal and state levels. The fifth objective is to compare and evaluate the energy efficient priorities of the two programs at the federal level.

Section 154 of the Energy Policy Act of 2005 requires HUD to create an "integrated strategy" to implement energy conservation and energy efficiency measures in design and construction of housing (U.S. HUD PD&R, 2006, p.1). HUD's 2006 report to Congress outlined 25 actions to accomplish the following departmental objectives:

- Promote ENERGY STAR products and standards in the residential sector;
- Provide improved incentives and establish new requirements for energy efficiency in programs;
- Provide energy efficiency and energy conservation training to program administrators and beneficiaries;
- Establish outcomes measures to track progress; and

- Continue research and technology development

(U.S. HUD PD&R, 2006).

To track success in reducing household energy, HUD has required grantees since 2007 to report the number of ENERGY STAR units constructed with HOME and CDBG funds (U.S. HUD PD&R, 2006). This data is tracked by HUD's Integrated Disbursement and Information System (IDIS) database, which also tracks other funding accomplishments and performance outcomes. It is important here to note that while reporting the number of new ENERGY STAR homes to HUD is required, it is voluntary for the grantees to implement the standards in the programs (U.S. HUD PD&R, 2008).

In June 2009, the U.S. Department of Transportation (DOT), HUD, and EPA formed the "Partnership for Sustainable Communities" (Partnership for Sustainable Communities, 2013). The federal agencies were charged with combining resources and goals to implement livability principles that include:

- "Provide more transportation choices" to reduce transportation costs;
- "Promote equitable, affordable housing" that is energy efficient and a smaller portion of household income;
- "Enhance economic competitiveness" with workforce training and development;
- "Support existing communities" with mixed-use development and community revitalization strategies;
- "Coordinate policies and leverage investment" to promote funding agency collaboration; and
- "Value communities and neighborhoods" with distinct qualities.

(Partnership for Sustainable Communities, 2013, p.1)

As part of its 2010-2015 Strategic Plan, HUD committed to promote "cost-effective energy and green retrofits" of affordable housing programs it supports, along with reducing

the amount of household income expended on housing costs (U.S. HUD, 2010, p.8). Both CDBG and HOME programs are in position to address these goals.

### **HOME Program Energy Efficiency Progress at the Federal Level**

In 2008, HUD issued guidance to grantees to promote and implement ENERGY STAR products and design in the HOME program. Previous performance indicates that while single-family homes are eligible to be served by ENERGY STAR standards, due to the “strict performance standards that must be met, homes that undergo less extensive rehabilitation are unlikely to cost-effectively meet” the standard (U.S. HUD CPD, 2008, p.15). Thus, HUD outlined procedures to guide grantees in establishing a program for new construction of ENERGY STAR qualified homes. The recommended process involves grantees to (1) require ENERGY STAR standards in performance goals and measures, (2) collaborate with developers and certified HERS raters for the construction and certification process, and (3) provide education to the housing occupants about energy conservation behaviors. Recommended practices to educate occupants include reducing lighting utilization, using a programmable thermostat, and operating clothes washers and dishwashers with full loads (U.S. HUD CPD, 2008). HUD identified the following key strategies in implementing a successful ENERGY STAR program:

1. Examine local program funding priorities that can incorporate ENERGY STAR standards;
2. Identify local capacity and program partners;
3. Determine whether to have ENERGY STAR as a recommendation or requirement in the program;
4. Revise program guidelines;
5. Train program staff and educate program partners;
6. Implement and monitor the program; and

7. Report program outcomes.

(U.S. HUD CPD, 2008).

According to HUD's 2008 national energy progress report to Congress, HOME funding constructed approximately 3,800 new ENERGY STAR homes in 2007 and approximately 4,600 in 2008 (U.S. HUD PD&R, 2008).

**CDBG Program Energy Efficiency Progress at the Federal Level**

The CDBG program has had less success in constructing ENERGY STAR housing units than HOME-funded programs. According to HUD's 2008 energy progress report to Congress, 125 new homes in 2007 and 250 homes in 2008 were constructed across the country to meet ENERGY STAR standards with CDBG funds (U.S. HUD PD&R, 2008). In April 2013, HUD issued a policy notice, "Using Community Development Block Grant (CDBG) Funds to Develop ENERGY STAR- Certified Housing Units", that clarified reporting mechanisms (U.S. HUD CPD, 2013b). From 2008 to 2011, HUD verified that some grantees reported incorrect numbers of completed ENERGY STAR units, possibly due to lack of clarification of the standards. Nationally, approximately 1,300 new ENERGY STAR units have been constructed with CDBG funds, but this number does not indicate how many of the units are single-family or multi-family. While HOME funds are specifically geared toward affordable housing, CDBG grantees have greater flexibility using funds to target local community needs identified through the citizen participation process, and therefore do not always use CDBG funds to address housing.

ENERGY STAR standards are more appropriate for new housing construction (U.S. HUD CPD, 2013b). The EPA is investigating different ENERGY STAR certification

standards for single-family housing rehabilitation. Currently, existing homes that are rehabilitated need to meet the standard for new homes (U.S. HUD CPD, 2013b). While it may be challenging to implement an ENERGY STAR single-family housing program with CDBG funds, HUD still encourages grantees to utilize ENERGY STAR improvements where feasible.

### **Other Model Energy Efficiency Strategies**

In 2011, HUD issued energy efficiency guidance for its supportive housing programs for the elderly and disabled (U.S. HUD PD&R, 2011). The guidance highlighted case studies and reiterated the need for partnerships across agencies to implement successful projects. Various energy efficiency measures implemented among the case studies were ENERGY STAR appliances and retrofits, the whole-home ENERGY STAR designation certified by third party HERS raters, and LEED certification of homes.

Table 6 summarizes the common strategies identified among the case studies that can serve as examples for other programs. First, project coordinators must analyze existing data to determine project need, feasibility, and opportunities for energy-efficiency measures. Next, project coordinators choose an execution based on individual energy component (e.g., light fixtures), specific site needs (energy efficient measures best for the site), or overall portfolio (a combination). An optional third step is to choose a certification program such as ENERGY STAR, LEED, or other green building certification recognition. This step requires the funding agency to have partnerships or contractual relationships with a certification provider to verify that construction meets the specific standards. The agency must also have

the administrative capacity and financial management in place for a successful partnership with a certification program. A crucial component is to have project partners familiar with the certification standards. Next, base project funding needs to be secured. For some projects, leveraging for other funding, such as those presented in Table 5, is essential to close the gap between upfront project costs and eventual realized savings from energy efficiency and conservation measures. It is important to remember that many funding agencies have specific requirements that the project team must have the capacity to meet. Lastly, and possibly most importantly, beneficiaries of the project who are provided this opportunity of energy-efficient affordable housing must be educated about energy conservation behaviors for continued financial and energy savings. True energy-efficient housing project success is achieved when project beneficiaries and project implementation teams provide program support, and projects can illustrate having lasting impacts to communities. Demonstrating measurable, long-term benefits to communities is a crucial factor in providing justification to federal, state, and local agencies to continue funding such sustainable initiatives (U.S. HUD PD&R, 2011).

## **STATE PROGRAM IMPLEMENTATION AND EFFECTIVENESS**

To meet the second goal of this project, the sixth project objective is to compare energy efficient policies and priorities of the HUD-funded programs at the state level. As previously mentioned, both the CDBG and HOME programs have been required since 2007 to report to HUD the number of ENERGY STAR housing units completed (U.S. HUD PD&R, 2006). The method of this reporting is quarterly through HUD's IDIS database and the annually with the Consolidated Annual Performance and Evaluation Report (CAPER). The North Carolina Consolidated Plan partners are in the 2011-2015 reporting period (N.C. DOC DCA, 2013b). The 2011 and 2012 annual CAPER reports are available for review, but the final 2013 CAPER is not available for review as of this writing.

### **State HOME - Single Family Rehabilitation Program**

Eligible activities of the HOME Single Family Rehabilitation (SFR) program administered by the North Carolina Housing Finance Agency (NCHFA) include housing rehabilitation, capped at \$45,000 (NCHFA, n.d.b). In the 2011 and 2012 program funding years, no policies existed that require grantees to construct and certify ENERGY STAR units (NCHFA, 2011b; NCHFA, 2012). However, energy efficient construction and installation of energy efficient appliances were highly encouraged. The 2011 and 2012 CAPER did not identify any construction of certified ENERGY STAR homes (N.C. DOC Consolidated Plan Partners, 2012; N.C. DOC Consolidated Plan Partners, 2013).

In June 2013, NCHFA issued new program guidelines that require all units assisted to meet HPwES standards. NCHFA responded to HUD's aforementioned 2008 strategy to

incorporate ENERGY STAR practices into HOME-funded projects (U.S. HUD CPD, 2008). NCHFA identified a funding opportunity, reinvigorated its existing partnership with Advanced Energy, and established HPwS as a requirement. Next, NCHFA revised program guidelines and provided training to staff and funding recipients. The grantees are monitored for implementation and reporting program accomplishments.

The HPwES construction standards include improvements to insulation, windows, ductwork, heating and cooling equipment, lighting and appliances, and third party verification (NCHFA, 2013). Each unit has the same \$45,000 expenditure cap for rehabilitation. Thus, in order to retain the budget cap and allow for implementation of HPwES standards that may be more expensive, grantees are potentially faced with placing restrictions on eligible homes that need fewer structural modifications.

As of December 2012, quarterly reports of ENERGY STAR units constructed with HOME funds are located on HUD's website for grantee and policy decision makers (U.S. HUD CPD, 2013a). Entitlement community HOME programs in North Carolina report successful completion of ENERGY STAR units (U.S. HUD CPD, 2013a). At the HOME-SFR program workshop in June 2014, NCHFA reported that only three HPwES units were constructed in the 2013 program thus far, compared to approximately 100 units completed in previous years without the HPwES standard requirement (NCHFA, 2014). Challenges that have hindered production thus far are adjusting the housing unit budgets, finalizing the legal framework for tri-party contracts, and streamlining Advanced Energy's approval process of housing unit work (NCHFA, 2014). Because the HPwES requirement is new, it is too soon

to measure program cost-effectiveness and successful implementation. However, NCHFA has a long-standing partnership with Advanced Energy, which is successful in implementing ENERGY STAR and *SystemVision*<sup>TM</sup> projects. In addition, NCHFA partners with homeownership counseling agencies, is a sponsor of the annual N.C. Affordable Housing Conference, and requires HOME recipients to provide success stories when housing units are completed (NCHFA, 2013). These well-established partnerships help market the availability of NCHFA's programs and help contribute in promoting the agency's mission to support creation of affordable housing opportunities across the state (NCHFA, n.d.a).

#### **State CDBG - Scattered Site Housing Program**

Eligible activities of North Carolina's non-entitlement CDBG Scattered Site Housing (SSH) program include housing rehabilitation, clearance and reconstruction, and emergency repair. Grantees submit annual reports to DCA and CFC that are compiled and reported in the annual CAPER. In the 2011 and 2012 program funding years, no policies existed that require grantees to construct and certify ENERGY STAR units (N.C. DOC DCA, 2011). However, energy efficient construction and installation of energy efficient appliances is encouraged for housing units (N.C. DOC DCA, 2012). The 2011 and 2012 CAPER did not indicate any construction of certified ENERGY STAR homes (N.C. DOC Consolidated Plan Partners, 2012; N.C. DOC Consolidated Plan Partners, 2013).

As described earlier, ENERGY STAR standards are more cost-effective to implement in planning new construction of homes (U.S. HUD CPD, 2008). Because the state's CDBG program allows for reconstruction of homes, opportunity exists for completion of ENERGY

STAR homes. However, because it is voluntary to implement such program requirements, grantees have so far opted not to construct ENERGY STAR homes. Energy efficient measures may have taken place in rehabilitation and reconstruction of homes, but specific standards have not been reported.

A challenge in establishing energy-efficiency program standards could be that DCA is not partnered with homeownership counseling agencies to educate homeowners, or Advanced Energy, the only ENERGY STAR sponsor in the state. In addition, DCA does not have the legal team that NCHFA has to assist the grant recipients with the homeowner eligibility process and finance contracting (NCHFA, 2014). Both NCHFA and DCA collaborate with the University of North Carolina at Chapel Hill School of Government and the N.C. Community Development Association to provide educational workshop programs. However, partially due to budgetary constraints, DCA does not have consistent strong presence with partners like NCHFA. In general, DCA lacks the marketing strategies that promote the benefits and successes of the program (COSFDA, 2013).

In July 2012, the N.C. General Assembly voted to reduce the allowable HUD allocation to Scattered Site Housing in half from what DCA proposed to HUD (COSFDA, 2013). In July 2013, the annual state budget removed all categories of CDBG funding except for infrastructure and economic development (N.C. Session Law 2013-360, 2013; N.C. Session Law 2013-363, 2013). The state budget also mandated that the Commerce Finance Center (CFC) continue to manage the economic development funding, while the N.C. Department of Environment and Natural Resources (DENR) manage the infrastructure

funding. While the state Consolidated Plan partner agencies manage separate funding streams, they must collaborate in reporting the HUD formula funding program goals and accomplishments. The addition of DENR creates new administrative challenges. The North Carolina Department of Commerce has the federal grant contract with HUD, so DENR is now a sub-grantee of N.C. Commerce. Although the Consolidated Plan partners conducted the citizen participation process and reported to HUD planned activities that included housing, the N.C. General Assembly changed allowable uses of grant funds. Therefore, until further notice, the 2012 CDBG Scattered Site Program is the last available federal funding cycle for substantial rehabilitation assistance for low-and moderate-income households in non-entitlement areas.

## ANALYSIS AND CONCLUSION

For low-income households across North Carolina, it can be difficult to invest in energy efficient home improvements when other living expenses such as food and healthcare take priority over energy-efficiency. The U.S. Department of Housing and Urban Development (HUD) provides federal funding assistance for housing and community development projects. The Community Development Block Grant Program (CDBG) and HOME Investment Partnerships Program (HOME) are two HUD programs that provide housing rehabilitation assistance to low-income households across North Carolina.

This study (1) examined if the homeowner needs of energy efficiency match the priorities of HUD-funded housing rehabilitation assistance programs in the state, and (2) investigated the process of integrating energy efficiency and conservation into the state's CDBG and HOME housing programs to propose changes in program administration for the next 5-year plan to ensure that the needs of low-income homeowners are being met. To accomplish the above goals, the following project objectives were required:

1. Compare funding objectives and eligibility criteria of HUD's CDBG and HOME programs;
2. Identify current baseline energy and electricity characteristics of the residential sector in North Carolina;
3. Identify baseline demographic and housing characteristics of North Carolina;
4. Identify examples of federal and state policies and standards that successfully integrate residential energy efficiency;

5. Identify HUD's energy efficiency policies; and
6. Compare the energy efficiency priorities of North Carolina's CDBG and HOME housing rehabilitation programs.

### **Homeowner Needs and Program Priorities**

First, this study introduces the CDBG and HOME programs, using information gathered from the federal and state program regulations, guidelines, action plans, and reports. The North Carolina Department of Commerce Division of Community Assistance (DCA) and North Carolina Housing Finance Agency (NCHFA) receive an annual allocation to administer the state's CDBG and HOME programs, respectively, and distribute funds to small local governments. As summarized in Table 1, the CDBG Scattered Site Housing (SSH) and the HOME Single Family Rehabilitation (SFR) programs target assistance to low-income households of owner-occupied single-family homes, with harmonizing strategies. Both programs distribute funding to a third of the counties in the state on a rotational basis, but are tools that serve the population in different ways. The CDBG-SSH program has a stricter income priority threshold than the HOME-SFR program. Households with incomes at or below 50% of area median income receive priority in the CDBG-SSH program (N.C. DOC DCA, 2012), while households with incomes at or below 80% area median income receive priority in the HOME program (NCHFA, 2013). The CDBG-SSH program does not limit the amount of money that can be spent on a house, while the HOME-SFR program limits the cost to \$45,000 per unit. Due to the cost limit, the HOME-SFR program restricts eligible activities to moderate housing rehabilitation. Meanwhile, the CDBG-SSH program

has a wider variety of eligible activities, including housing reconstruction. Another difference is that the CDBG-SSH program, counties have three years to expend the fixed grant amount received. With the HOME-SFR program, the counties receive a fixed allocation to expend funds on the two initial homes within the first eighteen months (NCHFA, 2014). Afterwards, the counties compete for the pool of funding that remains to assist homes. Finally, the most fundamental difference is that the CDBG-SSH program aims to address the worst housing conditions, while the HOME-SFR program aims to protect the affordability of the home for at least another generation.

To explore the affordability of residential energy in the state, the next project objective involved identification of baseline energy and electricity characteristics of North Carolina's residential sector. Data obtained from sources was categorized by sources of energy and electricity; residential energy and electricity utilization trends and projections; providers of electricity; and costs of electricity. Considering that North Carolina ranks nationally in the top 25% of states in residential energy consumption (U.S. DOE EIA, 2013l), this information is valuable to educate the public in making decisions about energy efficiency and conservation.

The primary sources of energy used for North Carolina's residential sector are coal, natural gas, and nuclear power (U.S. DOE EIA, 2012c). Both coal and nuclear power have to be converted to electricity prior to residential use (U.S. DOE EIA, 2013p). In 2011, coal generated close to two-thirds of North Carolina's overall electricity, while nuclear power generated about a third of the electricity. Nearly half of residential energy use in the country

is for space heating and cooling (U.S. DOE EIA, 2011b; U.S. DOE EIA, 2013o). Electricity powers space cooling, while electricity and natural gas power space heating. In North Carolina, the percentage of electricity used to generate residential heat is double the national percentage, and the state ranks 5<sup>th</sup> nationally in percentage of homes that use electricity for heat (U.S. Census ACS, 2009-2011c). Therefore, residential electricity in the state is examined further.

Electricity has evolved to be a larger portion of residential energy use in the last several decades (U.S. DOE EIA, 2013d) with the increased use of home electronics available to consumers (U.S. DOE EIA, 2012f). The U.S. Energy Information Administration predicts that energy efficient technology will contribute to the decline of individual residential electricity and energy consumption, but expects the number of households and size of homes to increase (U.S. DOE EIA, 2013f), and overall electricity demand to increase by 28% from 2011 to 2040.

As illustrated in Figure 3, a network of investor-owned utilities (IOUs), electric cooperatives (EMCs), and municipal public-owned utilities provides residential electricity in the state. Progress Energy became a subsidiary of Duke Energy in 2012, creating a large IOU territory that covers 90% of the state (Duke Energy Corporation, 2012; Carolina Country, 2013). Duke Energy Progress and Duke Energy Carolinas initiated electric rate increases in 2012 and 2013, respectively (Duke Energy Corporation, 2013c; Duke Energy Corporation, 2013d). Electric cooperatives primarily serve as distributors of electricity to rural areas of the state (Wichman and Hughes, 2011) and need to have higher electricity

prices to satisfy the purchase agreements with the IOUs (North Carolina Electric Cooperatives, n.d.a.; North Carolina Electric Cooperatives, n.d.c.). Municipal public power utilities have purchase and ownership agreements with IOUs, and most of them have debt remaining from investment in construction of nuclear power plants (ElectriCities, 2012a). This baseline energy and electricity data demonstrate that in general, electric utility providers with higher electric rates tend to serve the more rural counties in the state, and eligible service areas of the CDBG and HOME funding.

To further serve the project's first goal, baseline demographic and housing characteristics of North Carolina need to be identified. Data sets include degree of economic distress, population, degree of poverty, and age of and type of housing structures. North Carolina counties with greater economic distress tend to be rural areas with lower population density, lower household income, and higher percentages of the population in poverty. Counties with greater economic distress also tend to have older housing stock and a higher concentration of manufactured and mobile home units. The older and smaller manufactured and mobile homes across the nation tend to be occupied by lower income households (U.S. DOE EIA, 2013g). North Carolina has the sixth highest percent of manufactured and mobile homes in the nation (U.S. Census ACS, 2009-2011c). About a third of homeowners and half of renters in the state do not live in affordable homes (U.S. Census ACS, 2009-2011c; U.S. HUD CPD, n.d.a.). In addition, lower income households spend twice as much on energy costs than higher income households (U.S. DOE EIA, 2013h).

Based on the program eligibility criteria, energy and electricity characteristics, and housing characteristics presented, residents in North Carolina with the greatest need for affordable housing and energy-efficient housing are in the eligible service areas of the CDBG and HOME programs. The rural areas in the state with the highest electricity costs have older homes with more structural problems. Low-income households have the greatest need for energy-efficient housing assistance, so energy-efficient policies should be essential elements of affordable housing programs in the state. CDBG and HOME funds are the only federal funds in the state that provide the range of minor rehabilitation to complete housing reconstruction for single-family homes owned and occupied by low-income, elderly, and disabled. Therefore, to fully meet the needs of low-income homeowners, CDBG and HOME programs must incorporate energy-efficient housing policies, and need exists for improved funding opportunities for low-income households in the state.

### **Integrating Energy Efficiency**

To investigate the process of integrating energy efficiency into the HUD programs to make recommendations, examples of federal and state policies and standards that successfully integrate energy efficiency into housing need to be identified. These policies guide and govern the agencies and programs that can potentially provide funding assistance to homeowners who cannot afford to implement housing energy efficient improvements on their own. The federal government shows interest in energy efficiency and conservation with the Weatherization Assistance Program (U.S. DOE EERE, 2012a), regulatory policies such as federal department energy consumption standards (U.S. DOE EERE, 2010b), and

expanded energy standards for appliances and lighting (U.S. EPA, 2013a). North Carolina placed energy-efficient goals on the electric utilities (NCSU DSIRE, 2012) and adopted energy-efficient building codes (Hinton, 2012). The U.S. Department of Energy is also reviewing manufactured housing standards with HUD, and partners with the EPA to coordinate local Home Performance with ENERGY STAR (HPwES) programs. Both the Home Energy Rating System (HERS) Index and Leadership in Energy and Environmental Design (LEED) are nationally recognized frameworks available to consumers and decision-makers in the housing market.

In accordance with the fifth and sixth project objectives, it is necessary to identify and compare the energy-efficient policies of the HUD-funded CDBG and HOME programs at the federal and state levels. Within the past decade, HUD identified departmental actions and strategies that can incorporate energy efficiency and conservation measures in program design. HUD also partnered with other federal agencies to combine resources and principles to promote affordable energy-efficient housing. In addition, grantees are required to report to HUD the number of ENERGY STAR housing units constructed (U.S. HUD PD&R, 2006).

While HUD requires grantees to report performance measures, the data gathered do not fully describe program accomplishments. Although the programs require public comment processes, the flexible nature of the program allows local governments to select and address specific local community development needs from a variety of eligible uses of funds. Thus, no uniform standards of success exist (U.S. GAO, 2012a). HUD has also found inaccuracies in the ENERGY STAR data reported thus far (U.S. HUD CPD, 2013b). This

inaccuracy presents challenges in quantifying the impact of CDBG and HOME programs (U.S. GAO, 2012a), and consequently, any measurement of successful implementation and continued funding of affordable energy efficient housing rehabilitation programs.

HUD expresses that ENERGY STAR standards are best suited for construction of new homes rather than rehabilitation. Until the EPA finalizes a separate set of standards, housing retrofits must meet ENERGY STAR standards as if they were new units (U.S. HUD CPD, 2013b). Nonetheless, HUD at the national level still encourages HOME and CDBG programs to use cost-effective ENERGY STAR standards, and provides example strategies and methods to assist grantees. Because construction of ENERGY STAR units is a federal recommendation instead of a requirement, the administrative agencies in North Carolina must determine if the standards are appropriate and feasible to incorporate into the state's CDBG and HOME program requirements. Energy-efficiency policies of the CDBG and HOME programs are very different at the state level.

North Carolina's state partner agencies identified affordable housing opportunities as a priority. NCHFA recognizes the need to increase home energy costs as a part of increasing housing affordability. As of July 2013, the North Carolina HOME-SFR Program grantees are required to implement HPwES standards, but can still only provide minor rehabilitation with a maximum of \$45,000 expended on each home (NCHFA, 2013). The HPwES requirement is new and NCHFA is working through administrative challenges as they emerge (NCHFA, 2014). At this point, it is too soon to report success of the new HPwES standards for the SFR program because this is the first round and very few housing units are

completed. However, based on past performance of other residential energy efficiency projects with the agency's long-standing partnership with Advanced Energy, NCHFA anticipates a successful HPwES program (NCHFA, 2014).

Consistent with federal strategy, DCA encourages grantees of the North Carolina CDBG-SSH Program to incorporate energy-efficient standards with housing rehabilitation and reconstruction. HUD states that ENERGY STAR standards are more cost-effective in constructing new housing units, which an eligible activity in the state's CDBG-SSH program. However, non-entitlement CDBG grantees have not reported any housing units constructed with these standards. DCA collaborates with some of the same partners as NCHFA for educational outreach. However, partially due to budgetary constraints, DCA does not have adequate administrative tools and resources to have a consistent, positive, and proactive marketing strategy, and strong presence like NCHFA. DCA also lacks the HPwES technical expertise. In addition, due to the N.C. General Assembly's 2013 elimination of all programs except economic development and infrastructure, DCA no longer has an option to require ENERGY STAR standards until at least the state's 2016-2020 Consolidated Plan and *Analysis of Impediments to Fair Housing Choice Study* are complete.

Various reports, guidance documents, and initiatives have already been issued by HUD that provide methods and strategies to implement energy efficient housing construction in the national CDBG and HOME programs (U.S. HUD CPD, 2008; U.S. HUD PD&R, 2011). The North Carolina programs can follow the same strategies and methodology as presented by HUD in Table 6 (U.S. HUD CPD 2008; U.S. HUD PD&R, 2011). First,

NCHFA and DCA need to analyze data to establish existing conditions. NCHFA recognized the need and opportunity for energy-efficient affordable housing and therefore expanded its partnership with Advanced Energy. The next steps are to choose an approach and choose a standard. The CDBG and HOME program administrators need to decide whether to require only certain energy-efficient elements of homes, to address the most energy-efficient need(s) of the specific housing unit, or a combination. With the help of Advanced Energy, NCHFA now mandates HPwES standards for all homes in the HOME-SFR program (NCHFA 2013; NCHFA 2014). Meanwhile DCA shows no signs of requiring the HPwES standard or any other energy-efficient housing standard for CDBG-SSH funds (COSCONA, 2013; NCHFA, 2014). The next step is to secure funding. NCHFA has challenged HOME funding recipients to implement HPwES standards with the same housing unit budget as in previous funding years. The last HUD step is to educate homeowners and the funding recipient project managers. The NCHFA and Advanced Energy partnership possesses the capacity and resources to educate the builders, contractors, and homeowners they assist about energy conservation behaviors to maintain lower utility bills.

This research reveals that integration of energy efficiency policies in the residential sector is possible, but there are challenges. A disconnect exists between federal HUD recommendations and state implementation. HUD provides guidance for an integration strategy to grantees based on its own energy strategic plan to Congress. It is evident that NCHFA followed the recommended integration process, but DCA did not. However, if homes cannot be brought up to HPwES standards in the HOME-SFR program with the same

\$45,000 limit, they cannot meet NCHFA's new eligibility criteria. Low-income homeowners that could have been assisted with CDBG in the past can no longer receive assistance.

NCHFA does not currently have the capacity or funding to assist the low-income homeowners that used to be eligible for CDBG funding. The low-income homeowners with the worst living conditions and greatest need for housing and energy assistance no longer have a source of assistance. Elimination of CDBG housing funding contradicts the need for affordable housing opportunities identified in the state's previous reports and plans submitted to HUD.

### **State Program Recommendations**

Completion of the previous project objectives illustrate that need exists for funding opportunities for energy-efficient housing rehabilitation for low-income households across North Carolina. The CDBG and HOME programs are the only federal funds in the state that prioritize funding allocations to low-income households with eligible activities that range from moderate rehabilitation to complete housing reconstruction. With NCHFA's new HPwES standards, North Carolina now has a federal moderate housing rehabilitation program that also prioritizes residential energy efficiency. However, until the EPA establishes different sets of ENERGY STAR standards for new and existing homes, HPwES standards are more cost-effective to implement with new construction and less cost-effective with minor rehabilitation. Therefore, a program is needed that allows for new housing construction that also requires ENERGY STAR standards. Preparation for the upcoming 2016-2020 Consolidated Plan provides an opportunity for the state partner agencies to

reassess the formula-funding needs and priorities. Recommendations to modify policies of the state HOME and CDBG housing programs to prioritize residential energy efficiency are needed to ensure that the energy and housing needs of low-income homeowners across the state are being met.

Advanced Energy is the only ENERGY STAR sponsor in North Carolina, so that partnership needs to be maintained for ENERGY STAR certifications. Although CDBG-SSH funding is not currently available from the N.C. General Assembly, instead of starting a new process different from NCHFA, DCA should consider building upon the existing process to incorporate ENERGY STAR requirements.

NCHFA and DCA should discuss options with HUD and determine the feasibility of adjusting North Carolina's formula allocation (HOME, CDBG, ESG, and HOPWA funding) such that NCHFA receives more funding to absorb the housing rehabilitation that CDBG would have funded. In addition, the Consolidated Plan partners should work with partners to enhance education for affordable housing, market the program in a positive manner, and request support from HUD. If presented with support for the CDBG-SSH program from partnered agencies, the N.C. General Assembly may reinstate the CDBG-SSH program with the administrative resources it needs.

If NCHFA receives more housing funding, or if the N.C. General Assembly does not reinstate the CDBG-SSH program, NCHFA should consider releasing the \$45,000 unit cost limit and allow for reconstruction of housing units in the HOME-SFR program. If the CDBG-SSH program is reinstated, HPwES standards should be required for all

reconstruction units. In addition, for rehabilitation of existing housing units, DCA could also decide to require installation of ENERGY STAR components and products. If the HUD formula cannot be adjusted or if the N.C. General Assembly does not reinstate the CDBG housing program after the completion of the 2016-2020 Consolidated Plan, NCHFA and DHHS need to have a contingency plan in place to fund the additional energy-efficient housing rehabilitation assistance that the CDBG program could have provided.

NCHFA and DCA can collaborate with partners to educate homeowners, contractors, project managers, and grant recipients of energy-efficient technologies, energy conservation behaviors, and basic homeowner maintenance to ensure continued housing affordability and energy savings. This task can be accomplished by strengthening existing partnerships and seeking out new partnerships with entities such as local community services, schools, and non-profit organizations. In conjunction with the citizen participation process required for the Consolidated Plan, NCHFA and DCA need to reach out to funding recipients, homeowners, and other community development partners for feedback and objective facilitation of discussions. Some examples of such partners include the University of North Carolina School of Government, N.C. Community Development Association, N.C. State Energy Office, Advanced Energy, N.C. Housing Coalition, and Council of State Community Development Agencies (COSDA). DCA and NCHFA need to aggressively seek feedback from partners and homeowners while preparing for the 2016-2020 Consolidated Plan.

### **Areas of Further Study and Implications**

One of the program recommendations is to adjust the HUD formula funding allocation to North Carolina. Further study is needed to determine if that recommendation is even feasible. Another program recommendation is to enhance education and marketing for the programs and energy-efficiency. Both NCHFA and DCA have the capacity to strengthen partnerships, but there is currently no funding available for additional community outreach. In addition, the low-income elderly and disabled homeowners that benefit from this funding live in rural areas and may not have the capacity to attend educational programs. More analysis is needed to design a cost-efficient and effective community education program. Furthermore, the lack of universal performance measures of the program accomplishments make it difficult to illustrate justification for continued program funding in the state. Therefore, a more in-depth economic analysis of program accomplishments is needed.

The critical question is if the state funding is in jeopardy. The N.C. General Assembly adjusted allowable CDBG funding allocations to be solely for infrastructure and economic development projects. It is yet to be determined if this limited type of funding will have the same or better long-term impact in assisting low-income persons as housing rehabilitation. The N.C. General Assembly has illustrated its authority to overrule the funding priorities identified in the State's 2011-2015 Consolidated Plan, and can do the same for the 2016-2020 Consolidated Plan. If the North Carolina CDBG-SSH program is reinstated via the 2016-2020 Consolidated Plan, it is possible for the Division of Community Assistance to learn by North Carolina Housing Finance Agency's example in providing

affordable housing that is also energy-efficient. For decades, these two state agencies have worked well together, and through the citizen participation process, have provided a variety of avenues for local governments to address community and economic development needs of low-income persons across North Carolina.

**TABLES AND FIGURES**

**Table 1. Criteria of United States Department of Housing and Urban Development Programs in North Carolina, 2011-2013.**

<b>CRITERIA</b>	<b>CDBG PROGRAM*</b>	<b>HOME PROGRAM**</b>
National Ranking	2nd highest allocation in U.S.	10th highest allocation in U.S.
State Agency Administration	N.C. Department of Commerce Division of Community Assistance (DCA)	N.C. Housing Finance Agency (NCHFA)
Housing Program	Scattered Site Housing (SSH)	Single-Family Rehabilitation (SFR)
Eligible Applicants	1/3 of counties (or designated lead municipalities) are eligible for non-competitive funding annually	1/3 of counties (or non-profit partners) are eligible for non-competitive funding annually
Eligible Household Income	Household income at 50% or below area median income (as calculated by HUD) receive priority	Household income at 80% or below area median income (as calculated by HUD) receive priority
Eligible Activities	Minor to substantial rehabilitation, clearance/ reconstruction on the same footprint, emergency repair	Moderate rehabilitation
Available Funding	Historically- approximately \$13 million statewide (\$400,000 per county). In 2012- approximately \$7 million (\$225,000 per county). In 2013 and 2014- \$0	Allocate approximately \$5 million statewide. Partners receive \$170,000 initially for the first 18 months to start 2 units. Afterwards, partners have access to the remaining "pool" of funds available, up to \$500,000
Unit Cost Limits	Minor rehab- \$40,000 or \$38 per square foot. Reconstruction- no limit, but requires prior approval by the State Emergency repair- \$5,000	\$45,000 per housing unit

\*(N.C. DOC DCA, 2011; N.C. DOC DCA, 2012).

\*\* (NCHFA, 2012; NCHFA, 2013).

**Table 2. United States Department of Housing and Urban Development Formula Grant Allocations to North Carolina, 2011-2013.**

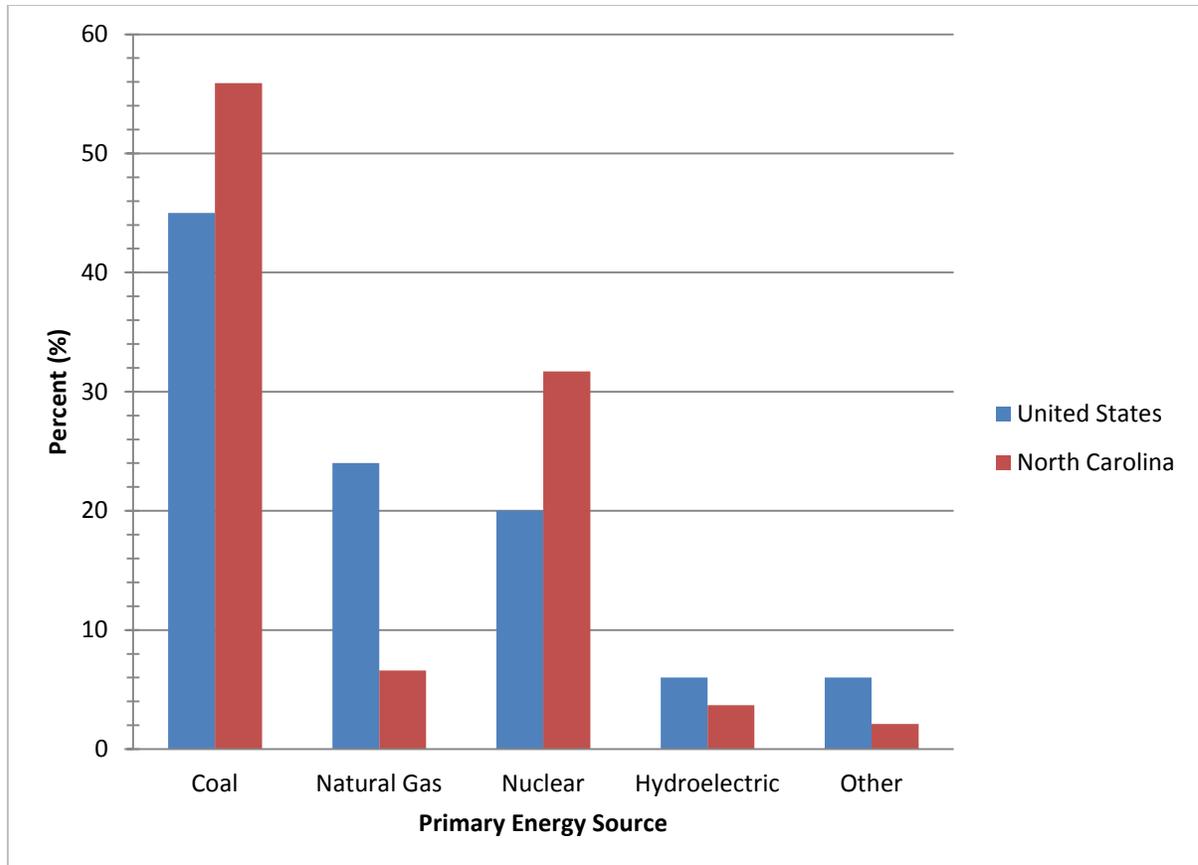
Program Year	State Program				State Total	Entitlement Total
	CDBG	HOME	ESG	HOPWA		
<b>2011*</b>	\$41,131,631	\$19,100,658	\$4,030,542	\$2,397,730	\$66,660,561	\$44,457,118
<b>2012**</b>	\$41,046,412	\$12,514,685	\$4,629,495	\$2,445,019	\$60,635,611	\$40,560,981
<b>2013***</b>	\$43,757,560	\$12,119,373	\$3,873,344	\$2,347,849	\$62,098,126	\$41,903,510

*\*(U.S. HUD CPD, 2011).*

*\*\* (U.S. HUD CPD, 2012).*

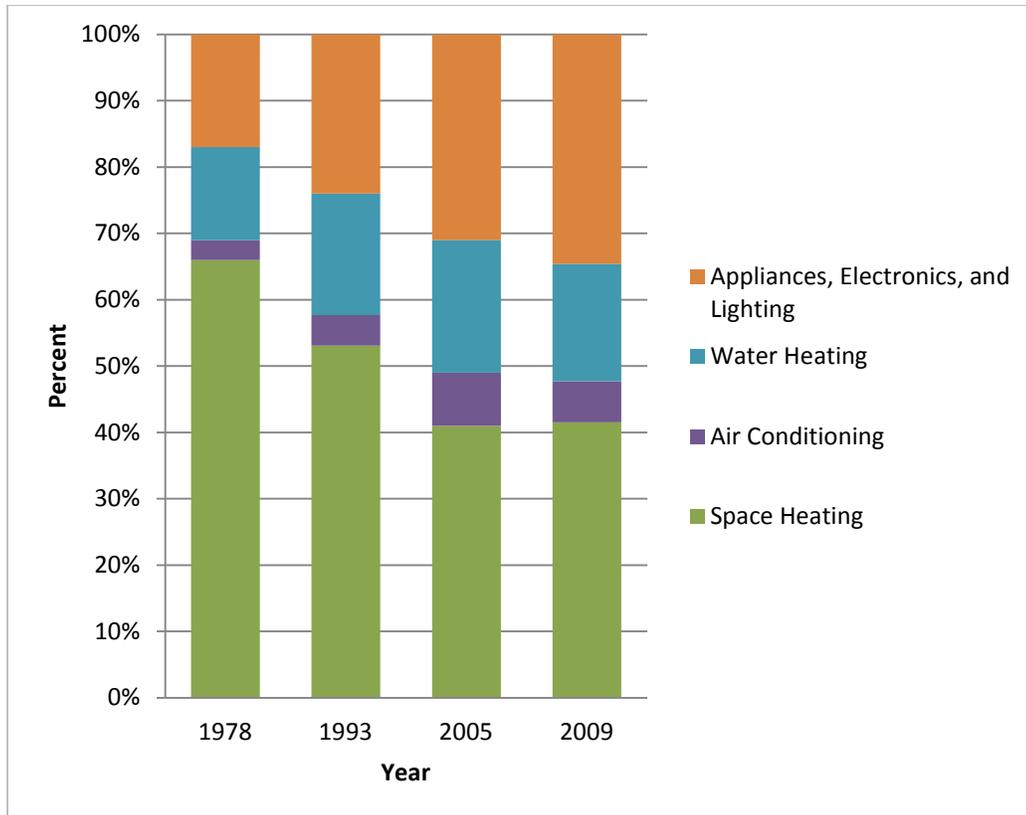
*\*\*\* (U.S. HUD CPD, n.d.c).*

(U.S. HUD CPD, n.d.e).



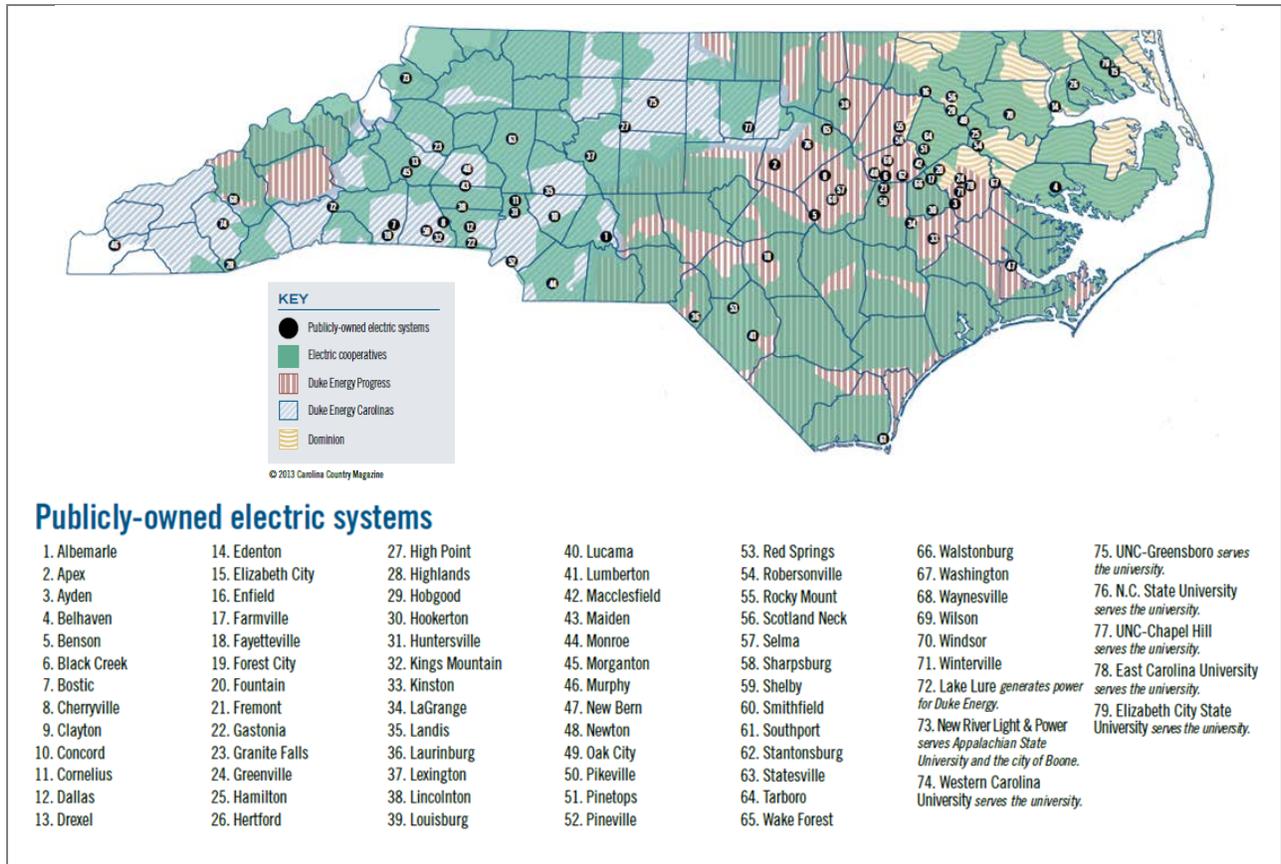
**Figure 1. Percent of Electricity Net Generation by Primary Fuel Source, 2010.**

(U.S. DOE EIA, 2011c; U.S. DOE EIA, 2012a).



**Figure 2. End Use Percent of Home Energy Consumption, 1978-2009.**

(U.S. DOE EIA, 2011b; U.S. DOE EIA, 2013d).



**Figure 3. Electric Utility Service Areas in North Carolina, 2013.**

(Carolina Country, 2013).

**Table 3. Retail Electricity Providers in North Carolina, 2011.**

2011 Provider	Number of Customers		Sales (Megawatt hours)		Revenues (Thousands of Dollars)		Average Price (cents/kWh)	
	All Sectors*	Residential Sector**	All Sectors	Residential Sector	All Sectors	Residential Sector	All Sectors	Residential Sector
Duke Energy Carolinas, LLC	1,853,838	1,587,296	55,430,896	21,277,645	4,171,486	1,947,851	7.53	9.15
Progress Energy Carolinas Inc.	1,277,207	1,086,976	37,353,311	15,518,535	3,235,956	1,570,133	8.66	10.12
Virginia Electric & Power Co	118,724	101,009	4,176,834	1,624,886	300,719	149,745	7.20	9.22
Subtotal	3,249,769	2,775,281	96,961,041	38,421,066	7,708,160.40	3,667,729	7.79	9.50
Cooperatives (31 Entities)	1,021,445	932066	18,025,522	13332467	1,941,229.80	1523875.3	11.49	12.01
Public (72 Entities)	586,214	494551	16,093,036	6302345	1,682,418.10	763011.1	11.63	12.62
Total	4,857,428	4,201,898	131,079,599	58,055,878	11,331,808.30	5,954,615	9.3	10.62

(\*U.S. DOE EIA, 2012i; \*\*U.S. DOE EIA, 2012h).

**Table 4. Monthly Electricity Costs, 2011.**

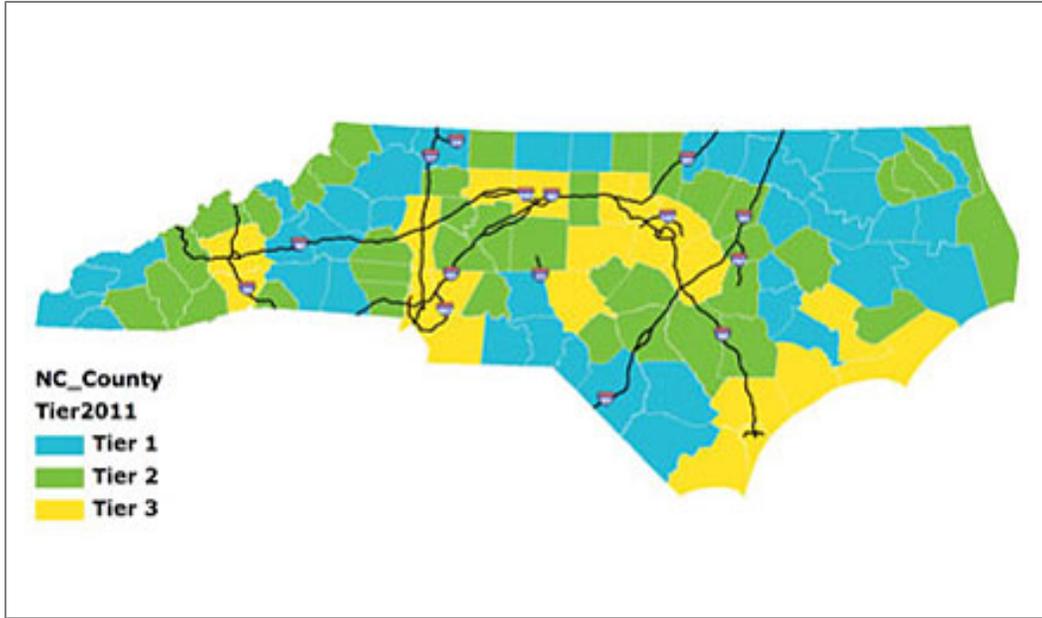
Sector/Entity	Number of Consumers	Average Monthly Consumption (kWh)	Price (Cents per Kilowatthour)	Monthly Bill (Dollars)
<b>Residential</b>				
N.C.*	4,201,898	1,151	10.26	\$118.09
U.S.*	126,143,072	940	11.72	\$110.14
<b>Commercial</b>				
N.C.**	644,926	6,004	8.13	\$488.42
U.S.**	17,638,062	6,275	10.23	\$642.20
<b>Industrial</b>				
N.C.***	10,609	208,586	6.01	\$12,546.21
U.S.***	727,920	113,487	6.82	\$7,739.60

*\*T5.a. Residential average monthly bill by census division and state, 2011.*

*\*\*T5.b. Commercial average monthly bill by census division and state, 2011.*

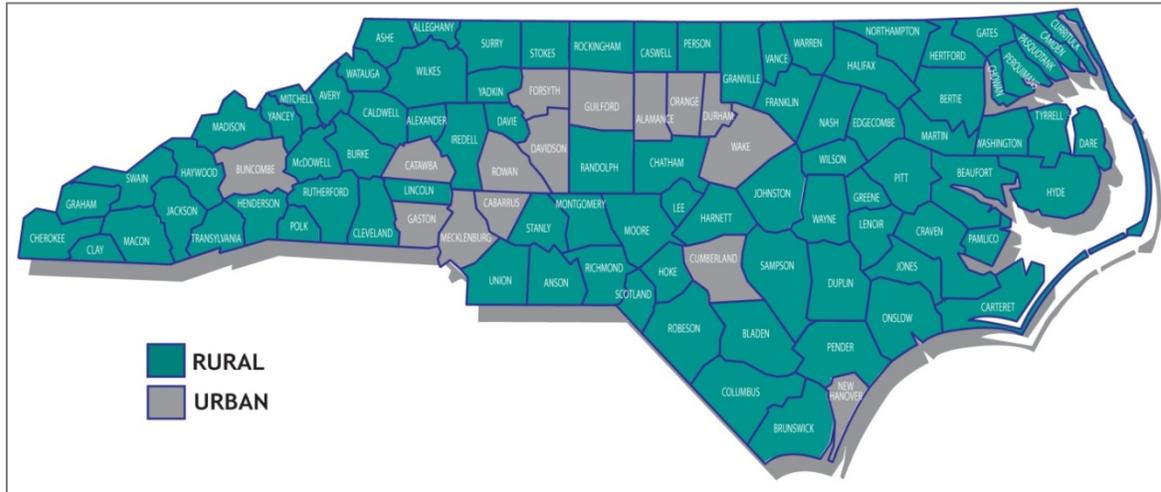
*\*\*\*T5.c. Industrial average monthly bill by census division and state, 2011.*

(U.S. DOE EIA, 2012g).



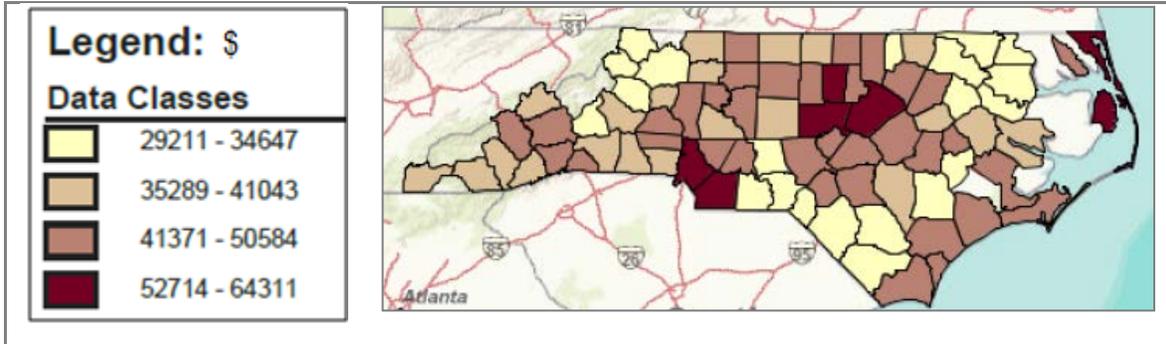
**Figure 4. County Tiers in North Carolina, 2011.**  
*Ranking of counties from most distressed (Tier 1) to least distressed (Tier 3).*

(North Carolina Department of Commerce, 2011).



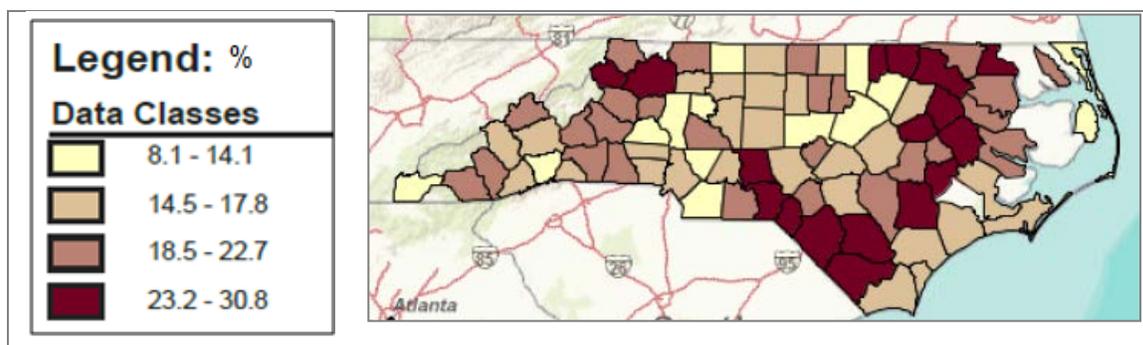
**Figure 5. County Urban and Rural Designations in North Carolina, 2012.**

(North Carolina Rural Economic Development Center, 2000-2012).



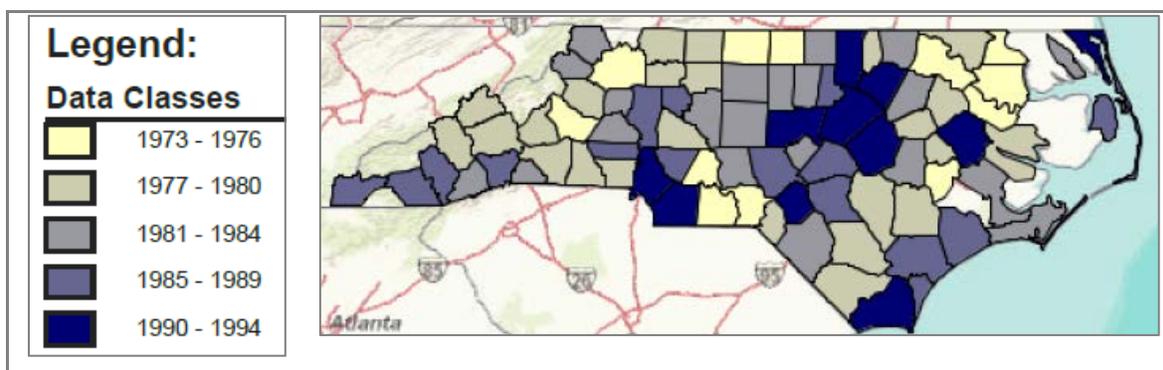
**Figure 6. Median Household Income by County in North Carolina, 2011.**

(U.S. Census ACS, 2009-2011c).



**Figure 7. Percent of Individuals Below the Poverty Level by County in North Carolina, 2011.**

(U.S. Census ACS, 2009-2011b).



**Figure 8. Median Year Housing Structure Built by County in North Carolina, 2011.**

(U.S. Census ACS, 2009-2011a).

**Table 5. Examples of Funding Sources for Energy Efficient Housing.**

<b>Summary of Potential Funding Sources</b>	
<b>New Construction</b>	<b>Rehabilitation</b>
<p><b>Federal:</b></p> <ul style="list-style-type: none"> <li>❖ Low-Income Housing Tax Credit Program (LIHTC)</li> <li>❖ Community Development Block Grant (CDBG)</li> <li>❖ HOME Investment Partnerships Program</li> <li>❖ Energy Efficiency and Conservation Block Grant (EECBG)</li> <li>❖ State Energy Program (SEP)</li> </ul>	<p><b>Federal:</b></p> <ul style="list-style-type: none"> <li>❖ Weatherization Assistance Program (WAP)</li> <li>❖ Community Development Block Grant (CDBG)</li> <li>❖ HOME Investment Partnerships Program</li> <li>❖ Energy Efficiency and Conservation Block Grant (EECBG)</li> <li>❖ State Energy Program (SEP)</li> </ul>
<p><b>Nonprofit and Foundation:</b></p> <ul style="list-style-type: none"> <li>❖ Enterprise Community Loan Fund</li> <li>❖ LEED Affordable Housing Grant Program</li> <li>❖ LEED Affordable Green Neighborhoods Grant Program</li> </ul>	<p><b>Nonprofit and Foundation:</b></p> <ul style="list-style-type: none"> <li>❖ Enterprise Community Green Mini Loans</li> <li>❖ LEED Affordable Green Neighborhoods Grant Program</li> </ul>
<p><b>Private:</b></p> <ul style="list-style-type: none"> <li>❖ Utility Incentive Program</li> </ul>	<p><b>Private:</b></p> <ul style="list-style-type: none"> <li>❖ Utility Incentive Program</li> </ul>

(U.S. HUD PD&amp;R, 2011).

**Table 6. Steps to Implement Energy Efficiency Standards in United States Department of Housing and Urban Development Programs.**

<b>Steps to Implement Energy Efficiency Standards</b>
<b>Step 1: Analyze Data</b>
<ul style="list-style-type: none"> <li>• New Construction or Substantial Rehabilitation</li> <li>• Energy Audits to prioritize energy efficiency measures</li> <li>• Benchmarks to compare to homes with similar characteristics</li> <li>• Utility Bill Analysis</li> </ul>
<b>Step 2: Choose an Approach</b>
<ul style="list-style-type: none"> <li>• Individual Component</li> <li>• Site-Specific Needs</li> <li>• Project Portfolio</li> </ul>
<b>Step 3: Choose a Standard</b>
<ul style="list-style-type: none"> <li>• ENERGY STAR</li> <li>• LEED</li> <li>• Other(s)</li> </ul>
<b>Step 4: Obtain Funding</b>
<ul style="list-style-type: none"> <li>• Federal</li> <li>• State/Local</li> <li>• Private</li> <li>• Non-Profit</li> </ul>
<b>Step 5: Educate Energy Consumers</b>
<ul style="list-style-type: none"> <li>• Tenants</li> <li>• Property Managers and Owners</li> <li>• Maintenance Personnel</li> </ul>

(U.S. HUD PD&R, 2011).

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**APPENDICES**

## **Appendix A- Power Plants with Shared Ownership**

Some of Duke Energy's power plants constructed in the 1970s and 1980s have shared ownership with other electric utilities in North Carolina. This Appendix contains information about these specific power plants.

North Carolina Eastern Municipal Power Agency (NCEMPA) owns a portion of two nuclear and two coal-fired electric power plants with Duke Energy Progress (ElectriCities, 2012a):

- Shearon Harris Nuclear Station- 16.17%
- Brunswick Nuclear Station- 18.33% of each Unit 1 and Unit 2
- Roxboro Steam Plant- 12.94% of Unit 4
- Mayo Steam Plant- 16.17% of Unit 1

The Catawba Nuclear Station, located in South Carolina, has been operational since 1985. The two units generate 2,258 megawatts (MW) of power. This facility is jointly owned by North Carolina Electric Membership Corporation (NCEMC), North Carolina Municipal Power Agency Number 1 (NCMPA1), and Duke Energy (Duke Energy Corporation, *Catawba*, n.d.). The licenses to operate expire in 2043 (ElectriCities, 2012a).

The Shearon Harris Nuclear Station in Wake County has been in operation since 1987, with a license good through 2046. The one-unit, 900 MW facility is owned by NCEMPA and Duke Energy (Duke Energy Corporation, n.d.e).

The McGuire Nuclear Station has been in operation in Mecklenburg County since 1981. The two units generate about 2,200 MW (Duke Energy Corporation, n.d.g). The operating licenses expire in 2041 for Unit 1 and 2043 for Unit 2 (ElectriCities, 2012a).

The Brunswick Nuclear Station near Wilmington has been operational since 1975. The two-unit facility generates 1,875 MW and is jointly owned by Duke Energy and NCEMPA. The operating licenses expire in 2034 for Unit 1 and 2036 for Unit 2 (Duke Energy Corporation, n.d.a).

The Roxboro Steam Plant is a 4-unit coal-fired plant in Caswell County. Operational since 1980, the facility generates 2,422 MW and is partially owned by NCEMPA (Duke Energy Corporation, n.d.i).

Also coal-fired, the one-unit Mayo Steam Plant in Person County generates 727 MW of electricity. Operational since 1983, the facility is partially owned by NCEMPA (Duke Energy Corporation, n.d.f).