February 15, 2013

The Economic, Utility Portfolio, and Rate Impact of Clean Energy Development in North Carolina

Final Report

Prepared for

North Carolina Sustainable Energy Association
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Raleigh, NC 27628

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Executive Summary

North Carolina is a leader among Southern states in developing public policies to foster statewide clean energy development. Between 2007 and 2012, clean energy investment increased 13-fold and generated or saved more than 8.2 million MWh of energy through a combination of renewable energy and energy efficiency projects.

Although these energy impacts have been documented in national energy surveys, the impact the expanding clean energy sector has had on the North Carolina economy has yet to be quantified. To fill the knowledge gap, RTI International and La Capra Associates, Inc. conducted an economic, utility, and rate impact analysis of clean energy development for the North Carolina Sustainable Energy Association (NCSEA).[1]

The analysis had three broad components:

1. RTI reviewed North Carolina's business and investment climate for clean energy development, including the effects of three key state policies: Renewable Energy and Energy Efficiency Portfolio Standard (REPS), renewable energy tax credit, and Utility Savings Initiative.
2. RTI performed a retrospective economic impact analysis of renewable energy and energy efficiency investment on the state economy between 2007 and 2012.
3. La Capra analyzed the rate impacts of clean energy development to date and expected in the future.

Our research findings are as follows:

- North Carolina's clean energy and energy efficiency programs achieved the following:
  – Spurred $1.4 billion in project investment statewide between 2007 and 2012. This was supported by the state at an estimated $72 million.
  – Contributed an estimated $1.7 billion between 2007 and 2012 to the gross state product, including secondary effects. This estimate includes renewable energy project construction and operation benefits, state costs and incentives, reduced conventional energy generation, utility customer fees, and energy efficiency benefits.
  – Created or retained 21,163 job years from 2007 to 2012.
- There is no appreciable rate impact to residential, commercial, and industrial customer groups through 2026 resulting from state renewable energy and energy efficiency policies. By 2026, this switch to clean energy will lead to $173 million in cost savings.
- Over the 20-year period since the start of clean energy policies in North Carolina, rates are expected to be lower than they would have been had the state continued to only use existing, conventional generation sources.

[1] NCSEA posed the research questions in the request for proposal and offered guidance in data collection during the research process. RTI and La Capra conducted the analysis in an independent and objective manner to address the research questions that resulted in the findings of this report.

1 Introduction and Methods

As demand for cleaner and cheaper energy continues to rise globally, regions are striving to build their competitive advantage in the clean energy industry. North Carolina has established itself as a leading Southern state in terms of developing policies to foster statewide clean energy development to support its clean energy sector.

Between 2007 and 2012, clean energy investment increased 13-fold and generated or saved an estimated 8.2 million MWh of energy through a combination of renewable energy and energy efficiency projects.

Between 2007 and 2012, clean energy investment increased 13-fold and generated or saved an estimated 8.2 million MWh of energy through a combination of renewable energy and energy efficiency projects. In addition, there was an estimated $427 million in energy savings from governmental energy efficiency programs. Although the energy-related impacts have been documented in annual energy surveys, to date the impact of clean energy development on North Carolina's economy has not been comprehensively measured to determine direct, indirect, and induced impacts.

Similar to other state investments in policies and programs that foster emerging industry sectors, it is critical to measure the impacts of clean energy development on the economy. A sound analysis cannot only address investment-related effects, but also the effects on energy consumers and job growth. These data help policy makers and stakeholders decipher the costs and benefits of policies to determine if the impact is worthwhile.

To this end, the NC Sustainable Energy Association (NCSEA) commissioned RTI International and La Capra Associates Inc. to conduct an independent and objective analysis of the economic, utility portfolio, and rate impact of clean energy development in North Carolina.[2]

The three primary research questions guiding this study were:

1. What are the key policy drivers of clean energy development in North Carolina?
2. What are the comprehensive retrospective statewide economic and fiscal impacts of clean energy development?
3. What are the utility portfolio and ratepayer impacts associated with clean energy development?

1.1 ANALYSIS METHODOLOGY

RTI and La Capra turned each research question into a task, devising a study approach and selecting methods that would answer the research questions rigorously while providing results that could be readily understood and communicated. The research began in November 2012 and concluded in February 2013. The methods employed for each research question are summarized below; in some cases, to facilitate interpretation of results, greater detail about our analytical approaches accompanies relevant results in later sections.

1.1.1 Question 1: What are the key policy drivers for clean energy development in North Carolina?

RTI employed primary and secondary data collection to identify statewide clean energy policies and key business and investment climate drivers that have encouraged the development of clean energy projects and the associated supply chain.

Data sources that informed our response to this question and Question 2, *What are the comprehensive retrospective statewide economic and fiscal impacts of clean energy development?,* were:

- informed discussions with clean energy industry stakeholders, including companies, investors, and regional and local economic developers;

[2] NCSEA posed the research questions in the request for proposal and offered guidance in data collection during the research process. RTI and La Capra conducted the analysis in an independent and objective manner to address the research questions that resulted in the findings of this report.

- the North Carolina Renewable Energy Tracking System (NC-RETS)[3] data on clean energy projects from which clean energy businesses were sampled; and
- peer-reviewed articles and utility industry literature that documented and analyzed the cost and performance of clean energy projects and the influence of state-level policies on clean energy development.

It should be noted that there are additional laws, policies, and programs related to renewable energy or energy efficiency development such as the federal business energy investment tax credits, building codes, and the North Carolina renewable energy equipment manufacturing tax credit. We did not explicitly examine these policy instruments for this study; the focus was on state-level renewable energy and energy efficiency deployment strategies.

1.1.2 Question 2: What are the comprehensive retrospective statewide economic and fiscal impacts of clean energy development?

The next step of the research was to quantify the net employment, fiscal, and economic output impacts of clean energy development on North Carolina's economy. RTI analyzed data collected from the NCUC, NC-RETS, and the U.S. Energy Information Administration (EIA), as well as data provided by La Capra and others.

RTI measured clean energy investments made in North Carolina over the 6-year period from 2007 to 2012 along multiple dimensions, including project value and megawatt capacity or equivalent. We then used a regional input-output (I-O) analysis to estimate the indirect (supply chain) and induced (consumer spending from increased labor income) impacts throughout the state economy resulting from those investments, including the net impacts of reduced conventional energy generation and government incentives over the study period.

More details on the data, methods, and assumptions used in this step are described in **Section 3** and **Section 4**.

[3] Established by the North Carolina Utilities Commission (NCUC), the database of registered renewable energy facilities and renewable energy certificates proved to be the most timely and thorough sources for clean energy development in North Carolina.

1.1.3 Question 3: What are the utility portfolio and ratepayer impacts associated with clean energy development?

The first step in determining the portfolio and ratepayer impact of clean energy policies was to identify a "Clean Energy Portfolio" of existing and projected renewable energy and energy efficiency resources brought (and expected to be) online between 2008 and 2026 as a result of clean energy policies. La Capra began with existing renewable resources and energy efficiency measures calculated in the economic impact analysis. We then modeled additional renewable resources and energy efficiency measures sufficient to comply with Renewable Energy and Energy Efficiency Portfolio Standard (REPS) through the end of the next decade. The prospective renewable resource mix and additional energy efficiency beyond REPS compliance was based on information in utilities' most recent Integrated Resource Plans (IRPs). Additional key sources for developing the Clean Energy Portfolio were NC-RETS, the 2012 NCUC Report on Long Range Resource Needs, and consultation with representatives of Duke Energy.

We then developed an alternative "Conventional Portfolio" based on the assumption that recent clean energy policies had not been enacted and that conventional resources would be needed to meet the same level of load for all years in the analysis period.

The rate impact of clean energy policies was calculated by comparing the incremental cost of the Clean Energy Portfolio with the Conventional Portfolio. A levelized cost of energy (LCOE) calculation was used to estimate the costs of different resources. LCOE estimates were calculated considering a number of resource-specific assumptions, such as capital and operating costs, project life, financing costs and structure, availability of production tax credits and accelerated depreciation, and interconnection and transmission upgrade costs. Key sources for the LCOE estimates included cost data from existing renewable resources and energy efficiency measures, the U.S. Department of Energy, La Capra Associates' 2011 REPS report for the North Carolina Energy Policy Council, consultation with key North Carolina stakeholders, and La Capra's industry knowledge and expertise developed over 30 years of analyzing energy policy effects.

1.2 RTI INTERNATIONAL AND LA CAPRA ASSOCIATES

RTI International is one of the world's leading nonprofit research institutes. Based in Research Triangle Park, North Carolina, RTI has a mission to improve the human condition by turning knowledge into practice. Founded in 1958 with the guidance of government, education, and business leaders in North Carolina, RTI was the first tenant of Research Triangle Park. Today we have 7 offices in the United States and 10 in international locations. We employ over 2,200 staff in North Carolina, 500 across the United States, and over 900 worldwide. RTI performs independent and objective analysis for governments and businesses in more than 75 countries in the areas of energy and the environment, health and pharmaceuticals, education and training, surveys and statistics, advanced technology, international development, economic and social policy, and laboratory testing and chemical analysis. In 2012 RTI's revenue was $734 million.

La Capra Associates Inc. is a full-service, independent energy consulting firm that provides objective analysis and strategic advice to help clients navigate the complexities and uncertainties of market and regulatory environments. The firm has specialized in the electric, natural gas, and water markets for over 30 years and helps clients make sound policy, planning, investment, pricing, and procurement decisions. Clients are across North America and include small and large utilities, energy market participants, consumers, regulatory commissions, public policy agencies, and financial entities.

1.3 REPORT OVERVIEW

The remaining sections of this report address the research questions posed. In **Section 2** we provide a description of North Carolina's policy drivers of clean energy development complemented by qualitative findings from informed discussions that highlight the state's strengths, weaknesses, opportunities, and threats in the clean energy industry. Economic and fiscal impacts are presented in **Section 3**, including a description of our methods, models, data, and a careful characterization of underlying assumptions. This is followed by **Section 4,** which provides an analysis of prospective rate impacts of clean energy policies. A brief technical appendix is included for reference.

2 Policy Drivers of Clean Energy Development

This chapter reviews North Carolina's clean energy policies since 2000 and analyzes their effects on the state's business and investment climate, with an emphasis on the period from 2007 through 2012. National and state policies help drive clean energy development, but for the purposes of this report we focus only on three prominent policies at the state level in North Carolina. We also summarize the insights about the competitiveness of the state's business climate gained from speaking with key clean energy stakeholders, including companies, investors, and economic developers. Finally, we compare North Carolina's clean energy policies with competitor states' clean energy policies.

2.1 CLEAN ENERGY POLICIES

Three state policies comprise the thrust of renewable energy and energy efficiency incentive programs to encourage investment in clean energy deployment in North Carolina:

- Renewable energy and Energy Efficiency Portfolio Standards (REPS)
- Renewable energy tax credits
- Utility Savings Initiative

In 2007, North Carolina established the REPS, which requires utilities to provide a percentage of their generation from renewable energy and energy efficient sources, including required set-asides from abundant North Carolina energy resources—solar and poultry and swine waste. North Carolina has offered a tax credit of up to 35% of the project investment value since 2000 for individual and corporate investors. The state-mandated Utility Savings Initiative created in fiscal year 2002–2003 is described by the North Carolina Department of Commerce Energy Division as a lead-by-example program for state agencies and other public facilities to reduce their use of energy, water, and other utilities.

We describe each of these main policies in greater detail in this section.

2.1.1 Renewable Energy and Energy Efficiency Portfolio Standard (REPS)

Established by Senate Bill 3 in 2007 and codified by final rules issued by the North Carolina Utilities Commission (NCUC), North Carolina's REPS requires all investor-owned utilities in the state to supply 12.5% of 2020 retail electricity sales in North Carolina from eligible energy resources by 2021. Municipal utilities and electric cooperatives must meet a target of 10% renewables by 2018 and are subject to slightly different rules.

According to Senate Bill 3, Session Law 2007-397, the REPS was established to promote the development of renewable energy and energy efficiency in North Carolina that would accomplish

- diversifying the energy resources used,
- providing greater energy security by using indigenous energy resources available within the state,
- encouraging private investment in renewable energy and energy efficiency, and
- providing improved air quality and other benefits to energy consumers and citizens of the state.

2.1.2 Renewable Energy Tax Credit

North Carolina has offered a renewable energy tax credit for individual and corporate investors since the 1970s energy crises. In its current form, a credit of 35% of the cost of construction, purchase, or lease of renewable energy projects using many technologies (see **Table 2-1**) may be taken over up to 5 years (for nonbusiness projects) or divided into five equal installments (for business projects). Tax credits may not exceed 50% of the taxpayer's net North Carolina state tax liability after all other state tax credits have been taken.

Table 2-1. North Carolina Renewable Energy and Energy Efficiency Policies: Summary Characteristics

NC Renewable Energy or Energy Efficiency Policy	Eligible Technologies	Credit or Standard	Maximum Incentives, Other Characteristics
Renewable Energy and Energy Efficiency Portfolio Standard Applicable sectors: investor-owned utility, rural electric cooperative, municipal utility	Energy efficiency: combined heat and power (CHP)/cogen, electricity demand reduction, unspecified technologies Renewable energy: Solar water heat, solar space heat, solar thermal electric, solar thermal process heat, photovoltaics (PV), Landfill gas (LFG, wind, biomass, geothermal electric, CHP/cogen, hydrogen, anaerobic digestion, small hydroelectric, tidal energy, wave energy	Investor-owned utilities: 12.5% by 2021 Municipal utility, cooperative: 10% by 2018	Technology standards: ▪ Solar: 0.2% by 2018 ▪ Swine waste: 0.2% by 2018 ▪ Poultry waste: 900,000 MWh by 2015 Credit trading through North Carolina Renewable Energy Tracking System (NC-RETS) Statutory per-account cost cap
Renewable Energy Tax Credit—Personal Applicable sectors: commercial, residential, multifamily residential	Passive solar space heat, solar water heat, solar space heat, solar thermal electric, solar thermal process heat, PV, landfill gas (LFG), wind, biomass, hydroelectric, geothermal heat pumps, CHP/cogen, spent pulping liquor, solar pool heating, daylighting, anaerobic digestion, small hydroelectric, ethanol, methanol, biodiesel, geothermal direct use	35% of cost of eligible renewable energy property constructed, purchased, or leased and placed into service in NC during the taxable year	▪ $3,500 per dwelling unit—active solar space heating, combined active and domestic water heating, and passive solar space heating for nonbusiness purpose ▪ $1,400 per installation for solar water heating for nonbusiness purpose ▪ $8,400 for geothermal heat pumps and geothermal equipment for nonbusiness purpose ▪ $10,500 for PV, wind, CHP, certain others, for nonbusiness purpose ▪ Unspent credits for nonbusiness projects may be carried over for 5 years ▪ $2.5 million per installation for all solar, wind, hydro, geothermal, CHP, and biomass used for business purpose; credit must be taken in five equal installments ▪ Allowable credit may not exceed 50% of state tax liability, reduced by all other state credits

(continued)

Table 2-1. North Carolina Renewable Energy and Energy Efficiency Policies: Summary Characteristics (continued)

NC Renewable Energy or Energy Efficiency Policy	Eligible Technologies	Credit or Standard	Maximum Incentives, Other Characteristics
Renewable Energy Tax Credit—Corporate Applicable sectors: commercial, industrial, agricultural	(same technologies)	(same)	▪ $2.5 million per installation ▪ Credit must be taken in five equal installments. ▪ Allowable credits must not exceed 50% of state tax liability, reduced by all other state credits
Utility Savings Initiative Applicable sectors: state agencies, UNC system universities, community colleges, public schools, county and municipal governments	Program components: ▪ Performance contracting: financing, designing, and building major projects that have a return on investment (ROI) in avoided utility costs ▪ Outreach: site visits, assistance in accessing resources ▪ Training, including energy management diploma and strategic energy plan development		Statutory requirements: ▪ Agencies and universities: 30% Btu/gsf/yr reduction from 2002–03 to 2014–15 ▪ Community colleges: must report consumption and cost annually ▪ Universities may keep savings from installing energy efficient devices and procedures with State Energy Office approval

Personal tax credits may be taken for commercial, single-family residential, or multifamily residential renewable energy projects. The maximum incentive for nonbusiness projects ranges from $1,400 to $10,500 depending on the renewable energy technology.

Corporate tax credits may be taken on commercial, industrial, or agricultural projects. The maximum incentive for personal business projects or corporate projects is $2.5 million per installation.

The renewable energy tax credit is scheduled to expire December 31, 2015.

2.1.3 Utility Savings Initiative

North Carolina's Utility Savings Initiative was created in 2002 to manage utility consumption and cost in the public sector. It fosters energy savings in public buildings through a multipronged effort incorporating mandated energy savings at agencies and universities, performance contracting, outreach, and training. Performance contracting is a method of financing, designing, and building major projects that have an ROI in avoided utility costs. It provides a way to replace obsolete and inefficient equipment using the utility savings to pay for the project. Outreach includes site visits and information sharing to help participants access resources to implement cost-effective projects. Training includes the Energy Management Diploma series, Strategic Energy Plan creation, and 1-day technical classes on specific building systems. According to the 2012 annual report for the initiative, since 2002 $12 million in state-appropriated funds to support the initiative has resulted in $553 million in avoided utility costs (NC Energy Office in the Department of Commerce, 2012).

2.1.4 Other Policies for Clean Energy

We recognize that these North Carolina programs are only a subset of the programs that encourage development of renewable energy or energy efficiency projects within North Carolina. Among the other policies, operating at the federal, state, and local levels, that we have not considered in this analysis explicitly are the:

- Federal Business Energy Investment Tax Credit;
- North Carolina Renewable Energy Equipment Manufacturers Tax Credit; and

- North Carolina Energy Conservation Code, which sets minimum energy efficiency requirements for various types of new construction.

2.2 PERSPECTIVES ON CLEAN ENERGY COMPETITIVENESS IN NORTH CAROLINA

To provide a stronger context for the policy drivers and impacts of clean energy development in North Carolina, RTI had informed conversations with a set of representative parties in key stakeholder groups in the clean energy industry to gain insights into the state's competitiveness for this sector. The purpose was to contextualize the research on policy drivers and economic impact with a stronger sense of the business and investment climate in which this industry sector functions in North Carolina. The main thrusts of the research in this report (**Sections 3** and **4**) focus on determining the economic impacts of clean energy development projects. It is important to understand that these projects, taken together, link to forming clean energy industry clusters for economic development throughout the state. For this reason we describe the business climate for fostering a clean energy industry sector.

In January and February 2013, we spoke with 14 individuals knowledgeable about the clean energy business climate, from the following kinds of organizations:

- small to medium-sized growth companies
- large established companies with clean energy business lines
- local or regional economic developers
- investors (e.g., venture capitalists, angel investors, and analysts who assess business potential for investors)

Individuals were selected independently by the RTI team, with additional assistance from our consultant, Dr. Vikram Rao.[4] To identify appropriate interviewees, we reviewed companies, economic development organizations, and investment groups of

[4] Dr. Vikram Rao is the executive director of the Research Triangle Energy Consortium (RTEC). Prior to this, Dr. Rao served as Senior Vice President and Chief Technology Officer at Halliburton.

relevance to this sector in the state.[5] Their key characteristics are shown in **Table 2-2**. RTI ensured that perspectives from multiple regions, company types, and a variety of energy specialties were represented.

Table 2-2. Characteristics of Key Stakeholders

Stakeholder Type	Number	Representative Professional Title(s)	Years of Experience	Geography Represented
Renewable energy or energy efficient company	3	Chief Executive Officer; Chief Operating Officer; Plant Manager	20–30	Global with NC operations; NC headquarters with regional or national reach
Economic developers	4	President and Vice President	10–35	Urban and rural NC regions
Investors	3	Partner, General Partner, Principal	15–22	Regional or national with NC headquarters
Other clean energy companies or stakeholders	4	Chief Financial Officer; Vice President; Attorney; Fellow	13–30	NC based with regional or national reach

We present our interview findings as themes in a strengths, weaknesses, opportunities, and threats (SWOT) framework. Our findings are not a comprehensive assessment of the competitiveness of this sector; rather, they serve as an informed starting point to understand the dynamics of the impact of clean energy development on the state economy.

2.2.1 Strengths

Table 2-3 lists the strengths and weaknesses gleaned from our discussions. They are listed in rough order of emphasis in which stakeholders mentioned them in conversations.

On the whole, common strengths for the state are its talented workforce, university presence and associated assets such as R&D, and university-industry partnerships. Also of importance is the business-friendly policy climate in North Carolina for

[5] We employed what is often termed a modified snowball approach whereby we asked individuals we spoke with for recommendations of others knowledgeable about the clean energy business climate in North Carolina, the Southeast, or the nation. If pertinent, RTI followed up with these individuals to request their insights on this topic. We ceased interviewing representatives within a stakeholder group when we heard no new information.

Table 2-3. Perspectives on Business Climate Strengths and Weaknesses

Strengths	Weaknesses
▪ Quality talent and workforce ▪ University assets and partnerships ▪ Friendly business climate: – Tax credits, REPS – Lower cost of living, labor, and overall business – Unique, positive confluence of tax and regulatory environment – Overall growth environment ▪ Government cooperation ▪ Established industry presence in small and large firms ▪ Economic history and established presence in energy sectors (e.g., Duke Power, Progress Energy, nuclear industry) ▪ Niche sectors (e.g. solar, waste-to-energy, biomass) conducive to job creation in urban and rural regions	▪ Insufficient resources to scale products and companies: – Demonstration and installation projects are cost prohibitive – Pool of professional managers to lead growth companies limited – Market opportunity to deploy load management innovations to utilities limited – Relatively smaller customer base ▪ Lack of patient capital, investment, and critical mass of deal flow, similar phenomenon as biotechnology in the 1980s ▪ Federal policy – Clean air regulations are cumbersome – No national energy policy ▪ Missing links in state economic development infrastructure, including weak: – Branding – Supply chains for growing sectors – State tax incentive packages – Connections between industry and policy makers

clean energy projects. Other strengths for the state include the presence of established and emerging clean energy companies, in addition to the strong energy tradition North Carolina has with the presence of Duke Energy, the former Progress Energy, and the nuclear industry. The presence of the utilities and the nuclear industry were viewed as important establishments that help seed both a professional talent pool and a wider understanding of the energy industry that helps facilitate growth in today's clean energy sector.

2.2.2 Weaknesses

Weaknesses in the business climate revolved around the need for the region to scale-up clean energy technologies and the companies that develop them. The failure to assist companies in the demonstration and installation phases of company growth was specifically mentioned as a state weakness.

Other weaknesses are emblematic of national[6] concerns: the high capital costs typically required for clean energy start-up companies and need for a long-term investment approach. Professional investors in North Carolina with whom we spoke mentioned that the venture capital community has a “bad taste in their mouth” about this sector from a few bad deals in the past. They also mentioned that as time passes and the market for this sector continues to demonstrate growing global demand, this apprehension in the investment community is subsiding.

Some state tax policies (incentive packages and income tax) were mentioned by companies as not being as competitive as others in states such as Georgia, Florida, Tennessee, and Texas. One business executive noted that although federal regulations, particularly federal air regulations for combustible clean energy sources, offer good guidance, they are cumbersome and cause significant delays in their ability to get to market faster. Other individuals commented on missing links in our economic development infrastructure, including the need for better branding for North Carolina business, supply chain build out, and stronger connections between industry and government.

2.2.3 Opportunities

Opportunities to expand growth and competitiveness in the clean energy sector, along with threats to constraining this growth are shown in **Table 2-4**.

The opportunities discussed are largely ways to leverage North Carolina’s strengths so that as the global market expands, so to can the competitive niche sectors emerging within the state. An economic developer from the Western part of the state captured what many said. He noted, “North Carolina has an opportunity to stand out [compared with other Southeastern states] in creating and attracting business in this sector … because of the jumpstart the state has made early on in this industry.” A focus on scaling up the demonstration capability of companies and deal flow within the region was mentioned as important, in addition to taking regional and cross-state

[6] Assessing national-level issues was outside the scope of this project; however, RTI understands that a business climate is largely driven at a national level and the state level. Thus, we include these comments as relevant to provide more holistic feedback.

Table 2-4. Perspectives on Business Climate Strengths and Weaknesses Opportunities and Threats

Opportunities	Threats
▪ Market growth – Global markets expanding and projected to increase – NC niche sectors with growth potential: energy and systems efficiency, solar, smart grid, waste to energy, biomass, natural gas, alternative fuel, potential for hydropower	▪ Potential state policy changes, including repeal of tax credits and REPS will: – Slow time to market, especially for wind, solar, and biomass – Threaten NC's status as a "first mover" in the region, which can stymie appeal from out-of-state investors – Send unclear signals to businesses and investors
▪ Attain critical mass and scale – Company presence – Expertise – Deal flow and investments – Municipal-level projects – Car and truck fleets to natural gas	▪ High upfront costs for in start-up companies, requires more capital and more patient capital – Compounded by lack of deal flow in the Southeast as compared with CA, TX, and MA ▪ Lower national energy prices are decreasing market absorption of clean energy
▪ Enhance economic development infrastructure – Create regional corridors based on energy, industry, innovation, and environmental assets that leverage competitiveness across state lines – Incubate policies and practices at local level, such as infrastructure for "green communities," and scale to enhance foundation for long-term growth – Establish stronger communication between industry and policy makers to convey speed and dynamics of this business climate – Strengthen coordination among economic development organizations – Build out supply chains in subsectors – Develop public-private partnership for clean energy similar to the biotechnology center in the 1980s to facilitate the state's competitive advantage	▪ Turf wars between some economic development entities harms ability to attract companies regionally
▪ Develop clean energy strategy for the state that is holistic in approach and allows for synergies between energy types	

(continued)

Table 2-4. Perspectives on Business Climate Opportunities and Threats (continued)

Opportunities	Threats
▪ Leverage existing assets better – Talent pool from larger utilities and recent Duke-Progress merger for sector growth – Military presence and quotas for clean energy	

approaches to these industry sectors. The I-85 corridor that runs along the Piedmont region in North Carolina shares clean energy assets with the upstate of South Carolina and eastern Tennessee. In addition, it was mentioned that eastern North Carolina can leverage the industry assets from Newport News, Virginia, to Charleston, South Carolina, and could ultimately enhance North Carolina's competitiveness.

The need to scale-up was also mentioned from a statewide strategic perspective. One economic developer representing a rural region said, "North Carolina has done the start-up strategy, now what is our growth path and let's communicate that to industry so they can move forward."

Stakeholders also noted that a public-private partnership to elevate the positive industry, university, and investment assets that already exist in the state could play a great role. As one business representative said, "There needs to be a public-private partnership to help the industry get over initial market failures and get technologies to market … to jumpstart the industry on the front end and then they need to get out of the way. It is amazing what markets will do." Several people made similar points referencing the state's long-term and successful investments in the biotechnology sector. Other means to better leverage existing assets that were discussed include finding ways to leverage the talent from the state's long-standing utility and nuclear sectors to help lead new growth in the broader clean energy sector.

2.2.4 Threats

Threats to the growth and expansion of this sector that stakeholders mentioned tended to be more pointed. They seemed to focus on three threats.

First, a repeal of the state policies that give North Carolina its competitive advantage would thwart growth for companies because it will slow their ability to get to market and thus create a drag on their current growth trajectories. Most companies said they did not base their costs on the policies, but the demand that these policies generate gives them an edge that is more comparable to key competitive states such as Texas and California. In terms of investing in the Southeast, it was mentioned that North Carolina could lose its status as a "first mover" in clean energy, leaving states such as Georgia to draw more attention from companies or investors seeking relocation or expansion locations. An economic developer commented that the current uncertainty in the policy climate "is already stalling projects." He said that a repeal of the state policy framework in place "will shut the state down" in terms of its ability to grow the clean energy sector. When asked how he would make the business climate more competitive he said that policies to reduce barriers for consumers to purchase clean energy would help facilitate growth. "If we don't create this market opportunity, these companies will go to states that are," he concluded.

Second, in general, the higher capital costs required for this sector can make investors "gun shy," as one venture capitalist noted. Drawing similarities to the biotechnology sector in the 1980s and 1990s, he noted that the returns are significant, but there is a longer time frame for the return, and the start-up costs are relatively high compared with other sectors such as information technology.

Third, some stakeholders noted that some counties are still engaged in economic development turf wars that harm our state's overall ability to attract and retain companies. If better cooperation does not prevail, the state as a whole could lose deals and investment because of a lack of a united front by regional and local economic developers.

2.3 COMPETITOR STATES

In our business climate discussions, we asked stakeholders about states that North Carolina tends to compete with for clean energy business development. The states mentioned were

- Arizona,
- California,

- Colorado,
- Florida,
- Georgia, and
- Texas.

To better gauge the status of North Carolina policy drivers with competitor states we reviewed policies in the Database of State Incentives for Renewables and Efficiency (DSIRE) managed by the North Carolina Solar Center and the Interstate Renewable Energy Council.[7]

We added states that are geographically competitive with North Carolina and represent the Southeastern United States. These states are

- Alabama,
- Mississippi,
- South Carolina,
- Tennessee,
- Virginia, and
- West Virginia.

In **Table 2-5** we show these states in alphabetical order with corresponding energy efficiency and renewable energy policies. Along with Arizona, Colorado, California, and Texas, North Carolina is only one of four states with a REPS. It is the only state in the Southeastern United States. Virginia has put a goal in place but has not yet set it as a standard to which utilities must comply. Florida, North Carolina, and Texas each have four policies and Colorado and California have five. Arizona is doing the most in terms of putting state policies in place to encourage project development in this sector.

[7] It should be noted that we selected key energy efficiency and renewable energy policies that serve as strong examples from which to compare North Carolina's policy efforts. A comprehensive catalog and assessment of all policies important for clean energy development was outside the scope of work.

Table 2-5. Clean Energy Policy Tools in Selected Competitor States Compared with Those in North Carolina

State	Energy Efficiency Resource Standards	Property Tax Incentives for Renewables	Rebate Programs for Renewables	Renewable Energy Portfolio Standard Policies	Sales Tax Incentives for Renewables	Tax Credits for Renewables
North Carolina		✓	✓-	✓		✓
Alabama						
Arizona	✓	✓	✓-	✓	✓	✓
California	✓	✓	✓	✓	✓	
Colorado	✓	✓	✓-	✓	✓	
Florida	✓*		✓-		✓	✓
Georgia			✓-		✓	✓
Kentucky					✓	✓
Mississippi						
South Carolina					✓	✓
Tennessee		✓			✓	
Texas	✓*	✓	✓-		✓	
Virginia	✓*				✓*	
West Virginia		✓				✓

✓* A goal is established not a standard.

✓- Utility, local, and/or nonprofit programs only.

Source: Database of State Incentives for Renewables and Efficiency: http://www.dsireusa.org/summarymaps/index.cfm?ee=1&RE=1

3 Economic Impacts

From 2007 through 2012, the clean energy sector in North Carolina spent $1,038 million on constructing renewable projects and $353 million on implementing energy efficiency programs. Investment accelerated throughout this period culminating in $409 million in renewable energy and $88 million in energy efficiency projects in 2012 alone.

Many North Carolina counties have benefited from this growth; Davidson, Person, and Robeson Counties have experienced more than $100 million in renewable energy project investment over the past 6 years.

Clean energy development contributed $1,705.2 million in gross state product growth, accompanied with a net increase of 21,163 job-years.[8] Despite state payments and tax credits, the state realized net positive fiscal impacts of $100.7 million.

3.1 ECONOMIC IMPACT ANALYSIS APPROACH

To measure how clean energy development influences the size of North Carolina's economy, we considered two effects.

1. Direct effects: Information was gathered to quantify the direct investment (expenditures) related to clean energy development over the period 2007 through 2012. The following impact categories were in scope: investment in renewable energy and energy efficiency projects, spending changes resulting from renewable energy generation and energy savings, and reduction in government spending on other services to account for the foregone tax credits (e.g., the costs of state policies).
2. Secondary effects: These direct economic impact estimates were then modeled using a regional input-output (I-O) model to measure the consequent indirect

[8] A job-year is one full-time equivalent job per year.

(supply chain) and induced (consumer spending) impacts resulting from clean energy development, throughout the North Carolina economy.

The first step yielded direct economic impacts, while the second step yielded secondary effects of the initial investments in clean energy. The total economy-wide impacts represent the combination of both these direct and secondary economic impacts.

Results are presented as the cumulative impact of clean energy development and operations on the North Carolina economy from 2007 through 2012. This cumulative number should not be interpreted as an annualized result.

3.2 ESTIMATED DIRECT IMPACTS OF CLEAN ENERGY DEVELOPMENT

The magnitude of investment in renewable energy and energy efficiency programs has varied considerably over the 6-year study period, with renewable energy project investment in 2012 increasing to 32 times the investment in 2007.

Figure 3-1 and **Table 3-1** show that the magnitude of investment in renewable energy and energy efficiency programs has varied considerably over the 6-year study period, with renewable energy project investment in 2012 increasing to 32 times the investment in 2007. Investment in 2012 was 36% of the total clean energy investment from 2007 to 2012.

In addition to demonstrating growth in economic activity over time, **Figure 3-1** and **Table 3-1** illustrate that state incentives were associated with energy efficiency and renewable energy investments that were more than 12 times as large as the state incentives. Although we do not attempt to statistically estimate the share of these investments that was motivated by these incentive programs, it is likely that there is a strong positive relationship.

Renewable energy investment was estimated primarily from facilities registered with North Carolina Renewable Energy Tracking System (NC-RETS), supplemented with data from the U.S. Energy Information Administration (EIA) EIA-860 and EIA-923 databases, North Carolina's Department of Environment and Natural Resources, dockets for individual projects, NC Green Power, and personal communication with industry experts to adjust reported data or address areas where information was incomplete.

Figure 3-1. Clean Energy Investment in North Carolina, 2007–2012

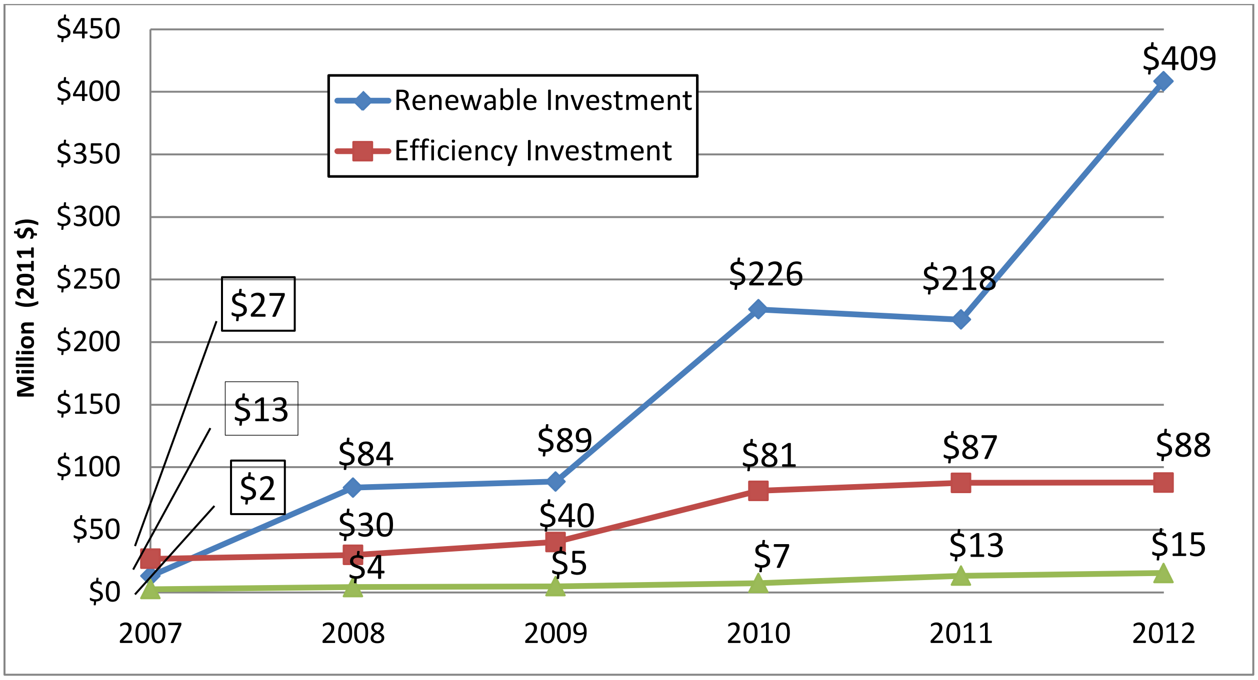


Table 3-1. Clean Energy Investment in North Carolina, 2007–2012

	Renewable Investment	Efficiency Investment	State Incentives
2007	$13	$27	$2
2008	$84	$30	$4
2009	$89	$40	$5
2010	$226	$81	$7
2011	$218	$87	$13
2012	$409	$88	$40
Total	$1,038	$353	$72

Tables 3-2 and **3-3** summarize the energy generated by renewable projects and the energy saved by energy efficiency projects. Renewable energy facilities generated 5,728 thousand MWh of energy between 2007 and 2012, with biomass and combined heat and power plants contributing 3,393 thousand MWh. The two energy efficiency programs produced large savings. The utility programs, those energy efficiency programs run by utility companies, produced 2,509 thousand MWh of energy saved. The Utility Savings Initiative, a government-run energy efficiency program, lacked data on specific MWh saved,

but the program saved $427.2 million on energy expenses over our study period.

Table 3-2. Renewable Energy Generation, 2007–2012

Technology	Facilities	Energy-Equivalent Generated (Thousand MWh)
Photovoltaic	863	261
Landfill gas	12	630
Hydroelectric	3	73
Biomass (including combined heat and power)	10	3,393
Wind	9	1
Solar thermal	77	27
Geothermal	646	29
Passive solar	N/A	1,314
Total	1,620	5,728

Table 3-3. Energy Efficiency Energy Savings, 2007–2012

	Energy Savings
Utility programs	2,509 thousand MWh
Utility Savings Initiative[a]	$427.2 million

[a] Energy savings are in 2011 dollars.

3.2.1 Investment Value of Clean Energy Projects

We estimated the investment value of these installations from reported costs in North Carolina Utilities Commission (NCUC) dockets, La Capra Associates' 2011 Renewable Energy and Energy Efficiency Portfolio Standard (REPS) report for the North Carolina Energy Policy Council, and other technology cost reports. Investments in energy efficiency are taken from program reports submitted by utilities to the NCUC and annual reports of the Utility Savings Initiative. **Table 3-4** summarizes the cumulative direct spending in renewable energy by category between 2007 and 2012.

Table 3-4. Direct Spending in Clean Energy Development by Technology, 2007–2012 ($ Million)

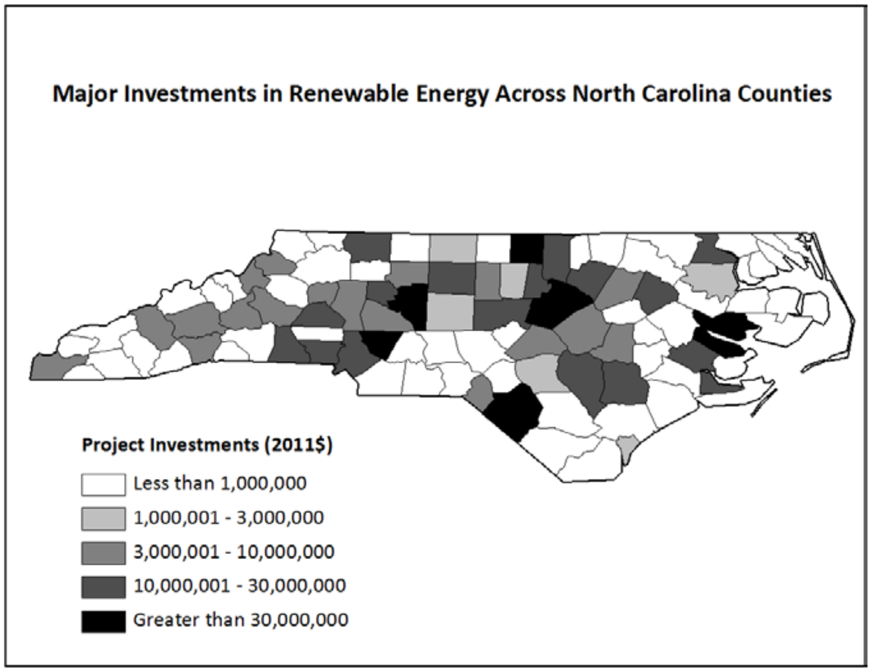
Category	Description	Value
Renewables direct investment	Solar photovoltaic	$743
	Biomass	$111
	Landfill gas	$102
	Hydroelectric power	$25
	Wind	$1
	Solar thermal	$36
	Geothermal	$18
	Passive solar	$1
	TOTAL	$1,038
Energy efficiency direct investment	Utility energy efficiency and demand-side management programs	$192
	Utility Savings Initiative	$161
	TOTAL	$353
Total		$1,391

Davidson, Person, and Robeson Counties have experienced more than $100 million in renewable energy project investment over the past 6 years, and Beaufort, Cabarrus, Catawba, Cleveland, Duplin, Mecklenburg, and Wake have had between $25 million and $100 million in renewable project investment.

These renewable energy projects installed over the 6-year period are widely distributed around North Carolina, bringing investment to both urban and rural counties. **Figure 3-2** below illustrates the geographic distribution of many of the renewable energy projects. Including all eligible wind, LFG, biomass, hydroelectric, solar photovoltaics (PV), and solar thermal projects valued over $1 million accounts for renewable project investment of approximately $918 million (88.4% of the total $1,038 million in renewable investment over the period).

Davidson, Person, and Robeson Counties have experienced more than $100 million in renewable energy project investment over the past 6 years, and Beaufort, Cabarrus, Catawba, Cleveland, Duplin, Mecklenburg, and Wake have had between $25 million and $100 million in renewable project investment. Interviewees from clean energy businesses confirmed positive relationships with local economic developers and noted that jobs were often created in rural counties that had been hard hit by contraction in the construction industry.

Figure 3-2. Distribution of Renewable Energy Projects Valued at $1 Million or Greater across North Carolina Counties



3.2.2 State Incentives for Clean Energy Investment

State incentives for clean energy investment, including the renewable tax credit and state appropriations for the Utility Savings Initiative, are modeled as a reduction in spending on other government services.

Investment spending was partially funded through state incentives. Renewable projects received $60.0 million in tax credits, while energy efficiency projects received $12.0 million from the state government via direct state appropriation. **Table 3-5** shows government expenditures for clean energy between 2007 and 2012.

For the purpose of this study, it was assumed that the money the government spent on renewable energy and energy efficiency was not spent on other government services. Thus, the government programs contributed to the positive investment in renewable energy and energy efficiency of $1,391 million. However, the $72 million spent on renewable energy and energy efficiency was shifted from what the government could have otherwise spent the money on, creating a minor offset that reduces absolute benefits slightly.

Table 3-5. State Incentives for Clean Energy Development, 2007–2012 ($)

	Renewable[a] (Tax Credit)	Energy Efficiency[b] (Utility Savings Initiative)	Total
2007	$477,491	$2,000,000	$2,477,491
2008	$2,218,603	$2,000,000	$4,218,603
2009	$2,816,785	$2,000,000	$4,816,785
2010	$5,397,327	$2,000,000	$7,397,327
2011	$11,295,327	$2,000,000	$13,295,327
2012	$37,802,355	$2,000,000	$39,802,355
Total	$60,007,888	$12,000,000	$72,007,888

Note: For the Utility Savings Initiative, an appropriation of $12 million was taken, which we distributed evenly across the study period for the purposes of the analysis. Tax credit for 2012 estimated; this estimation is in **Appendix A.**

Sources:

[a]North Carolina Department of Revenue. 2007–2011. Policy Analysis and Statistics Division, unaudited NC-478G.

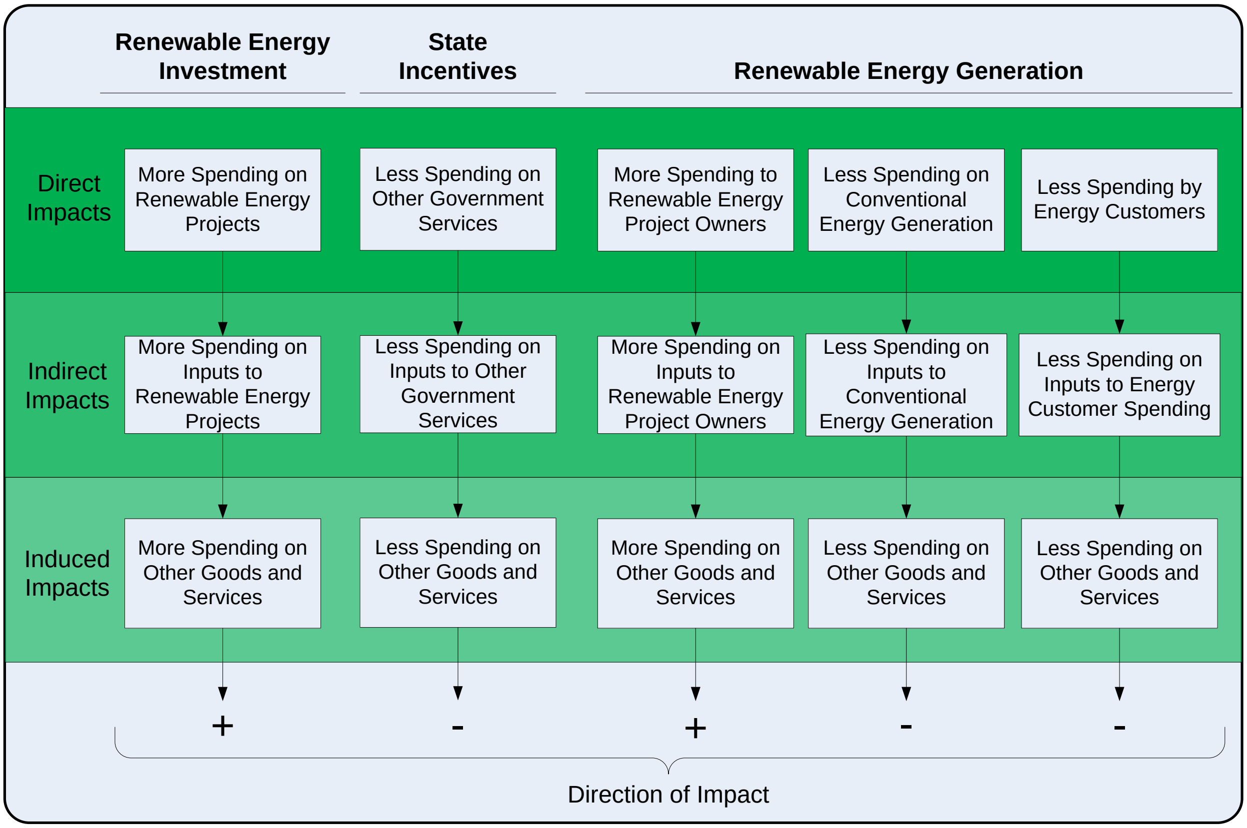
[b]North Carolina Department of Commerce. November 26, 2012. "2012 Utility Savings Initiative (USI) Annual Report."

3.3 ESTIMATED SECONDARY AND TOTAL ECONOMY-WIDE IMPACTS

To estimate the overall impact of clean energy development in North Carolina, we combined the spending quantified above with an I-O model of the North Carolina economy. The I-O model was constructed using IMPLAN software, which is widely used to assess regional economic impacts at the local, state, and regional levels (see **Figures 3-3** and **3-4** for a description of the direct, indirect, and induced impacts from renewable energy and energy efficiency projects).

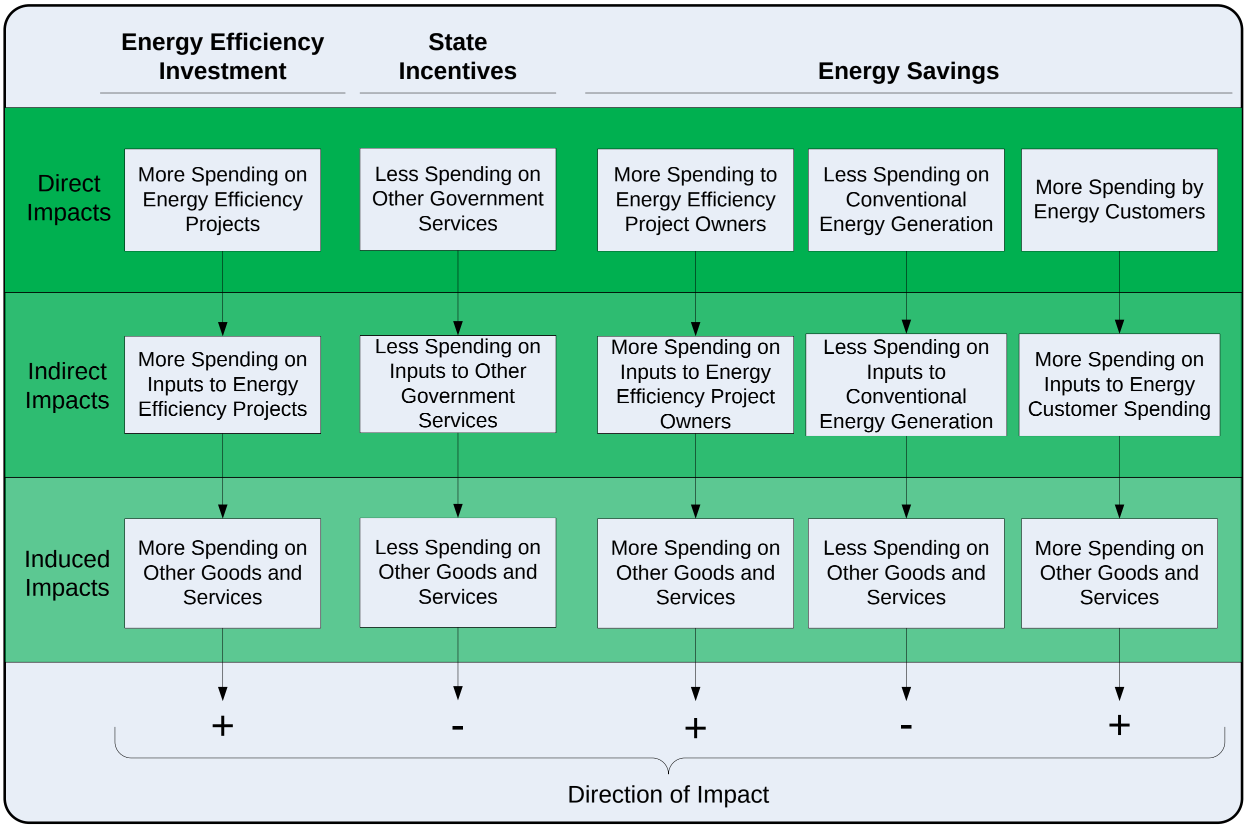
I-O models provide a detailed snapshot of the purchasing relationships between sectors in the regional economy. In response to these direct inputs, the IMPLAN I-O model estimates the increases in in-state output, employment, and spending within the supply chain for clean energy and the decreases in in-state output, employment, and spending within the supply chain for conventional energy.

Figure 3-3. Renewable Energy Direct, Indirect, and Induced Economic Impacts Related to Clean Energy Incentives



In addition, increased clean energy production requires increased employment in that sector and in the sectors in its supply chain. This increased employment, and associated increased income, will result in increased purchases of consumer goods and services within the state. The model estimates these increased household expenditures (induced impacts), including both the increased consumer spending derived from the increased direct and indirect employment associated with clean energy production and the decreased consumer spending resulting from decreased direct and indirect employment associated with conventional energy production. The total net economic impact of clean energy for North Carolina is the sum of the direct, indirect, and induced impacts.

Figure 3-4. Energy Efficiency Direct, Indirect, and Induced Economic Impacts Related to Clean Energy Incentives



3.3.1 Changes in North Carolina Spending Patterns and Secondary Economic Impacts

Two types of secondary economic impacts were modeled in this study. First, we modeled a secondary impact resulting from the value of investment dollars spent on a project. This represents induced and supply chain effects. Second, we modeled a secondary impact resulting from renewable and efficiency projects reducing production of conventional energy. Dollars that would have been spent on conventional energy are reallocated to energy efficiency and renewable project owners. Thus, energy efficiency and renewable energy change spending patterns, as detailed below.

3.3.2 Changes in North Carolina Spending Patterns from Renewable Energy Generation

To estimate the changes in spending resulting from renewable energy generation, we first estimated renewable energy produced by facilities by applying capacity factors, either at the facility level based on 2011 generation (EIA-923) or the technology level (see Table 4-1). Electricity generated by these facilities is assumed to receive $0.06/kWh[9] in avoided costs, which we modeled as a transfer to renewable generation from inputs to conventional generation. We modeled clean thermal energy produced by these facilities as a transfer of the retail electricity rate between utilities and utility customers ($0.0682/kWh for industrial and $0.99/kWh for commercial and residential customers [EIA, 2013]). Finally, we modeled the full REPS rider over these years as a transfer from utility customers to renewable project owners.

As **Table 3-2** stated, renewable energy facilities have generated an estimated 5,728 thousand MWh of energy over the study period. This generation is estimated to have resulted in a total of $276 million[10] in avoided cost and retail energy savings no longer spent on conventional energy. As **Table 3-6** shows, the total REPS rider over the study period is estimated to be $171 million.

Table 3-6. REPS Rider Spending, 2008–2012 ($ Millions)

	REPS Rider Spending
2008	$21
2009	$27
2010	$44
2011	$40
2012	$39
Total	$171

[9] Avoided costs received by qualified facilities vary by utility and length of contract. This value represents a central value among those reported in avoided cost schedules to NCUC.

[10] This $276 million was calculated by multiplying 3,328,008 MWh generated by non-thermal renewable projects by $60/MWh avoided cost to yield $194,280,455. The 1,120,193 industrial thermal MWh generated was multiplied by industrial retail savings of $68.20/MWh (EIA, 2012) to yield $76,397,148. Lastly, the 56,502 commercial and residential thermal MWh generated was multiplied by the average retail savings of $99/MWh (EIA, 2012) to yield $5,593,711. Summing the three totals together yields $276,271,314.

3.3.3 Changes in North Carolina Spending Patterns from Energy Efficiency

To estimate changes in spending resulting from energy savings, we assumed that the avoided cost of energy saved by utility energy efficiency and demand-side management programs is a transfer from the inputs of conventional energy generation to both utilities and utility customers, in line with Duke Energy's Save-A-Watt program. Energy savings from the Utility Savings Initiative were assumed to be a transfer from utilities to government spending. A full description of how these assumptions were implemented in IMPLAN is provided in **Appendix A**.

Combining this $150 million with the $427 million saved by the Utility Savings Initiative, total energy efficiency savings was $577 million.

As **Table 3-3** indicated, utility programs yielded 2,509 thousand MWh in energy savings. The avoided cost for these programs, assuming $0.06/kWh stated previously, was $150 million.[11] Combining this with the $427 million saved by the Utility Savings Initiative, total energy efficiency savings was $577 million.

3.4 SUMMARY RESULT AND CONCLUSION

The IMPLAN model estimated, for each direct renewable energy or energy efficiency expenditure, two secondary effects: (1) the associated supply-chain purchases of inputs from within the state and (2) the household expenditures to purchase goods and services within the state. The sum of the direct and secondary effects is a measure of the total size of the clean energy economic impact in North Carolina. Because the direct spending over the period 2007 to 2012 was cumulative, the resulting output, employment, and fiscal impacts represent the total economic impact over the 6-year period.

Spending in the state associated with clean energy development is estimated at $2,563.6.67 billion million over the 6 years. Clean energy development, and associated supply chain and consumer spending, is estimated to account for 21,163 job-years, an average of 4,233 jobs over these years and increasing rapidly.

Tables 3-7, **3-8**, and **3-9** show the direct, secondary, and total impacts for renewable energy, energy efficiency, and totals of these programs.

Overall, spending in the state associated with clean energy development is estimated at $2,563.6 million over 6 years. Clean energy development, and associated supply chain and consumer spending, is estimated to account for 21,163 job-years, an average of 4,233 jobs over these years and increasing rapidly.

[11] The avoided cost was calculated by multiplying 2,508,848 MWh by $60/MWh avoided cost to yield $150,530,880.

Ratios

For every $1 spent on renewable energy projects $1.90 was added to output.

For every $1 spent on energy efficiency projects, $1.67 was added to output.

An important number in thinking about the economic impact of clean energy is to quantify how much total output is being generated for every dollar invested. Renewable energy projects spent $1,038 million over the 6-year study period and generated $1,975.1 million of output, representing a ratio of $1,975.1/$1,038, or approximately 1.90. This means for every $1 spent on renewable projects, $1.90 was added to output.

The ratio for energy efficiency projects can be calculated with the $353 million invested and the $589 million output generated, or $589/$353 is approximately 1.67. This means for every $1 spent on energy efficiency projects, $1.67 was added to output.

Table 3-7. Renewable Energy Economic Impacts, 2007–2012

	Total Output ($ Million)	Gross State Product[a] ($ Million)	Employment (Job-Years)	Fiscal Impacts ($ Million)
Direct economic impact from renewable energy	1,037.9	625.2	7,375	72.1
Direct economic impact from change in government spending	−48.2	−41.4	−672	−1.6
Secondary economic impact	985.4	664.4	5,416	42.3
Total economic impact	1,975.1	1,248.2	12,119	112.9

[a] Gross state product represents the total value added. Note: Sums may not add to totals because of rounding.

Table 3-8. Energy Efficiency Economic Impacts, 2007–2012

	Total Output ($ Million)	Gross State Product[a] ($ Million)	Employment (Job-Years)	Fiscal Impacts ($ Million)
Direct economic impact from energy efficiency	352.8	195.7	2,643	10.1
Direct economic impact from change in government spending	−9.7	−8.3	−135	−0.3
Secondary economic impact	245.5	269.7	6,536	-21.9
Total economic impact	589	457	9,044	−12.2

[a] Gross state product represents the total value added. Note: Sums may not add to totals because of rounding.

Table 3-9. Total Clean Energy Impacts: Renewable + Energy Efficiency, 2007–2012

	Total Output ($ Million)	Gross State Product[a] ($ Million)	Employment (Job-Years)	Fiscal Impacts ($ Million)
Direct economic impact	1,332.8	771.1	9,211	80.3
Secondary economic impact	1,230.8	934.1	11,952	20.4
Total economic impact	2,563.6	1,705.2	21,163	100.7

[a] Gross state product represents the total value added. Note: Sums may not add to totals because of rounding.

As shown in **Table 3-7**, the $1,038 million investment in renewable facilities accounts for the majority of the economic impacts, with an estimated 12,119 job-years and $1,975.1 million in total economic output attributable to this investment. Although the economic output and fiscal impacts are estimated to be positive, we estimated that the substitution of renewable energy for conventional energy is a slight negative to employment over the study period, primarily because of reduced consumer spending from the REPS rider.

We estimated that the $353 million investment and $427 million energy savings in energy efficiency over the study period is associated with over 9,044 job-years and $589 million in total economic output. Energy savings resulted primarily from the Utility Savings Initiative and a larger employment multiplier on a dollar of government spending than on a dollar paid to utilities. We estimated a net negative fiscal impact for energy savings, as more state and local taxes are estimated to be recovered from a dollar of spending on utilities than on other government services.

Focusing on **Table 3-7** and **Table 3-8**, the rows labeled “Direct economic impact from change in government spending” represent the economic impacts of government spending on tax credits and the Utility Savings Initiative. The government spending resulted in an offset because it was assumed that this money was being taken away from spending on other government services. The specific government spending row in **Table 3-7** shows the impact of the $60 million spent on the tax credit. The reduction in government spending due to the tax credit reduced output by $48.2 million, before accounting for increases in other sectors. The similar government spending row **Table 3-8** represents the impact of the $12 million appropriations for the Utility Savings Initiative. Thus, the total offset associated with government spending changes because the tax credit and appropriations for the Utility Savings Initiative was $57.9 million of lost output. It should be noted that these losses are due to a reduction of government spending and not from any assumed issues with governmental involvement in the energy sector.

Total fiscal impacts, after accounting for the tax credit estimated to total $60 million from 2007–2012, is a net positive of $112.9 million for the state.

Of particular interest to state government is the state's return on its investment in renewable energy and the overall impact on state and local government revenues. Focusing specifically on renewable technologies, as stated in **Table 3-5,** tax credits for projects set in place between 2007 and 2012 are estimated to total $60 million, including an estimated $38.6 million that is forecast by RTI to be claimed for 2012 renewable energy projects. The last row of **Table 3-7** shows the total economic impacts of the renewable investment, renewable energy generation, and tax credits. The last column representing total fiscal impacts shows that after accounting for the tax credit, the fiscal impact is a net positive of $112.9 million for the state.

The substitution of conventional energy purchased from outside of North Carolina with in-state renewable energy is expected to fully recover any future tax credits through state and local tax revenues over the lifetime of the projects.

Renewable energy projects are underway across the state and future tax credit obligations are being generated. However, the substitution of conventional energy purchased from outside of North Carolina with in-state renewable energy is expected to fully recover any future tax credits through state and local tax revenues over the lifetime of the projects (National Renewable Energy Laboratory [NREL], 2010).

4 Prospective Rate Impacts of Clean Energy Policies

In this section, we discuss the rate impacts of North Carolina's clean energy policies. Although we analyzed and calculated rate impacts throughout the entire study period (2008 to 2026), this analysis combined both retrospective (2008 to 2012) and prospective analyses (2013 to 2026). As a result, we compared two scenarios—one where existing clean energy policies are in place throughout the study period and one where only the energy policies prior to 2007 are in place.

4.1 METHODOLOGY

We first developed an incremental Clean Energy Portfolio, which is the portion of the total statewide resource portfolio that is attributable to the state's clean energy policies enacted since 2007. The primary driving policies considered for the incremental portfolio are energy efficiency cost recovery mechanisms and the Renewable Energy and Energy Efficiency Portfolio Standard (REPS), but we also included additional policies, such as the renewable energy tax credit. We then developed an alternative Conventional Portfolio based on an assumption that recent clean energy policies had not been enacted and that alternative (nonrenewable and nonenergy efficiency) resources would be needed to meet the same level of load. The development of the Clean Energy and Conventional Portfolios is described in more detail below. Finally, we assumed that there is a base portfolio, consisting of resources existing prior to 2008, which is common to both the Clean Energy and Conventional Portfolios and is used to serve the large majority of the electricity needs of North Carolina households and businesses.

The rate impact of clean energy policies was calculated by comparing the incremental cost of the Clean Energy Portfolio with the Conventional Portfolio. Using the build-outs discussed later in this section, we calculated production by year of each resource in both portfolios. The cost of the incremental portfolio was then calculated as the levelized cost of each technology multiplied by the amount of energy generated by that technology for each year. The cost of out-of-state renewable energy certificates (RECs) was estimated based on the assumed market price of those RECs.

A levelized cost of energy (LCOE) calculation was used to estimate the costs of different resources. Levelized costs provide an estimate of the necessary revenue per unit of electricity (kWh or MWh) to be received over the life of the project to pay for all capital, financing, and operating costs and provide an adequate return to investors. LCOE estimates were calculated considering a number of resource-specific assumptions, such as capital and operating costs, project life, financing costs and structure, availability of production tax credits and accelerated depreciation, and interconnection and transmission upgrade costs. For most technologies, capital costs were modeled as constant in real terms, while the capital costs of solar were assumed to decline in real terms over time because of projected future improvements in manufacturing scale economies and technological advances. Assumptions for our levelized cost analysis are shown in **Table 4-1**.

Overall LCOE levels are affected by interaction among all the assumptions listed in **Table 4-1**. For example, the higher the installed cost, the higher the LCOE, but if this installed cost can be spread over a larger level of production (as indicated in the capacity factor column in **Table 4-1**), then the impacts of higher installed costs are mitigated. Solar resources, due to their high installed cost and relatively low capacity factors, have the highest LCOEs in the early years, but solar costs are expected to fall rapidly and be below the costs of swine and poultry waste in later years of the study period.

Table 4-1. Levelized Cost Assumptions (2011$)

Resource Block	Capacity Factor	Modeled Project Size (MW)	2013 Installed Cost ($/kW)	2020 Installed Cost ($/kW)	Technology Decline Rate (% in Real$)	Fixed O&M[a] ($/kW-yr)	Variable O&M Costs ($/MWh)	Fuel Heat Rate (Btu/kWh)	Fuel Costs ($/mmBtu)	PTC[b] Eligible
Onshore wind	30%	100	$2,500	$2,500	0.0%	$38	$0	—	—	100%
Solar photovoltaic (PV)										
System average	19%	2	$4,513	$3,151	5.0%	$26	$0	—	—	0%
<10 kW	19%	0.01	$6,815	$4,759	5.0%	$26	$0	—	—	0%
10 kW–100 kW	19%	0.05	$5,580	$3,897	5.0%	$26	$0	—	—	0%
100 kW–1 MW	19%	0.5	$4,573	$3,193	5.0%	$26	$0	—	—	0%
1 MW–2 MW	19%	1.5	$4,157	$2,903	5.0%	$26	$0	—	—	0%
>2 MW	19%	5	$3,602	$2,515	5.0%	$26	$0	—	—	0%
Solar thermal	42%	2	$6680	$5,400	3.0%	$10	$0	—	—	0%
Biomass co-firing	70%	20	$440	$440	0.0%	$0	$0	12,000	$2.75	0%
Dedicated biomass	80%	50	$3,343	$3,343	0.0%	$101	$3.00	13,500	$2.75	50%
Poultry waste	90%	35	$3,700	$3,700	0.0%	$100	$10.00	13,000	$5.00	50%
Swine waste	75%	0.15	$5,000	$5,000	0.0%	$270	$0	—	—	50%
Hydropower	45%	2.5	$3,030	$3,030	0.0%	$21	$5.00	—	—	100%
Landfill gas	85%	5	$2,450	$2,450	0.0%	$119	$0	13,650	—	100%
Gas combined cycle—Conventional	70%	530	$888	$888	0.0%	$14	$3.43	7,050	$5.34	0%
Coal variable cost only	70%	801	$0	$0	0.0%		$4.39	8,800	$4.09	0%

[a] O&M = Operations and maintenance
[b] PTC= Production tax credit

4.2 DEVELOPING THE CLEAN ENERGY PORTFOLIO

The first step in developing the Clean Energy Portfolio was to determine the amount of renewable energy capacity already installed that is eligible for REPS compliance as a “new renewable energy facility.”[12] We began with existing (as of 2012) renewable resources and energy efficiency measures identified in the economic impact analysis. We assumed that sufficient renewable resources would be added from 2013 to 2026 to ensure compliance with REPS (given additional assumptions as described below). We did not assume a least-cost approach to REPS compliance; rather, we assumed a combination of wind, biomass, and solar PV resources would be added from 2013 to 2015 as projected in Duke Energy Carolina’s 2012 Integrated Resource Plan (IRP). Thus, the rate impacts shown below would decrease if lower cost REPS-compliant resources, such as onshore wind, were deployed instead of higher cost resources, such as solar. However, we did assume that solar resources built to meet the general REPS requirement (after achieving full compliance with the solar set-aside) would be “utility scale” and thus enjoy scale economies compared with smaller facilities. The cumulative installed capacity of “new” renewable resources in the Clean Energy Portfolio is shown in **Table 4-2**.

We estimated REPS requirements through 2026 based on data and projections in utilities’ latest REPS compliance reports and the 2012 North Carolina Utilities Commission (NCUC) Report on Long-Range Resource Needs. REPS requirements differ for three groups of utilities. Dominion North Carolina Power is allowed to purchase RECs) from out-of-state facilities for 100% of its compliance. Electric membership corporations and municipalities have a slightly lower requirement than investor-owned utilities (IOUs) and have more resource options for compliance—notably from existing renewable energy facilities, including allocations made by the Southeastern Power Administration. Duke and Progress

[12] Per the REPS definition in G.S. §62-133.8(a). Note that some exceptions to the vintage requirement (notably small hydro and NC GreenPower resources) allow certain pre–2008 facilities to qualify as “new.”

Table 4-2. Cumulative Capacity (MW) of "New Renewable Energy Facilities" as Defined by G.S. §62-133.8(a) in the Clean Energy Portfolio

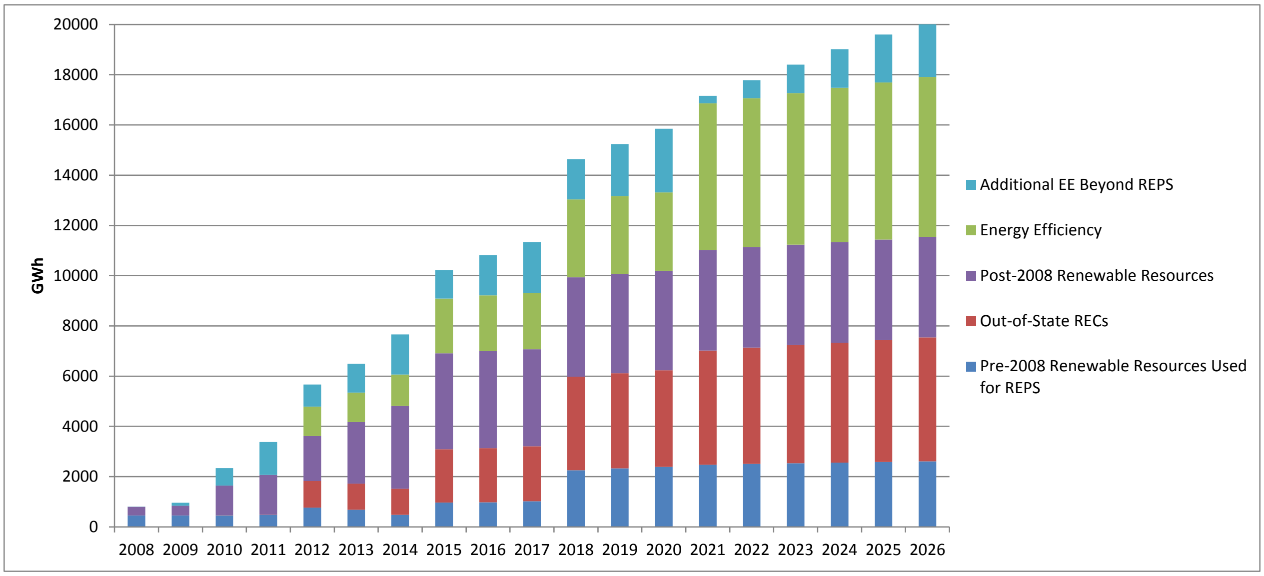
Resource Type	Pre–2008	2012	2014	2016	2018	2020	2022
Solar PV	0.2	149	268	386	386	386	386
Poultry waste	0.5	1	91	116	116	116	116
Swine waste	—	0	15	30	45	45	45
Dedicated biomass	104	136	156	166	166	166	166
Biomass co-fire	—	79	79	79	79	79	79
Landfill gas	14	57	62	69	69	69	75
Hydro	49	68	68	68	68	68	68
Wind	—	0	100	100	100	100	100
Solar thermal	—	9	9	9	9	9	9
Biomass thermal	—	81	81	81	81	81	81
TOTAL	**167**	**581**	**929**	**1,104**	**1,119**	**1,119**	**1,119**

(and, going forward, the merged Duke Energy) are the only utilities required by REPS to meet a portion of the REPS general requirement with energy from new renewable energy facilities. We also assumed that utilities would use out-of-state RECs (which are anticipated to continue to be cheaper than in-state RECs) to the maximum allowed percentage of the compliance requirement.

Energy efficiency is a critical element of the Clean Energy Portfolio. We relied on RTI data for energy efficiency savings achieved through 2012. For 2013 to 2026, we used projections from the 2012 IRPs of Duke, Progress, and North Carolina Electric Membership Corporation. We then estimated the prorated North Carolina share of system-wide energy efficiency savings based on retail sales. Based on our review of the IRPs, we project that IOUs will exceed the maximum energy efficiency savings that can be used toward compliance with REPS.

Figure 4-1 shows the level of energy efficiency savings and renewable energy for REPS compliance assumed in our Clean Energy Portfolio.

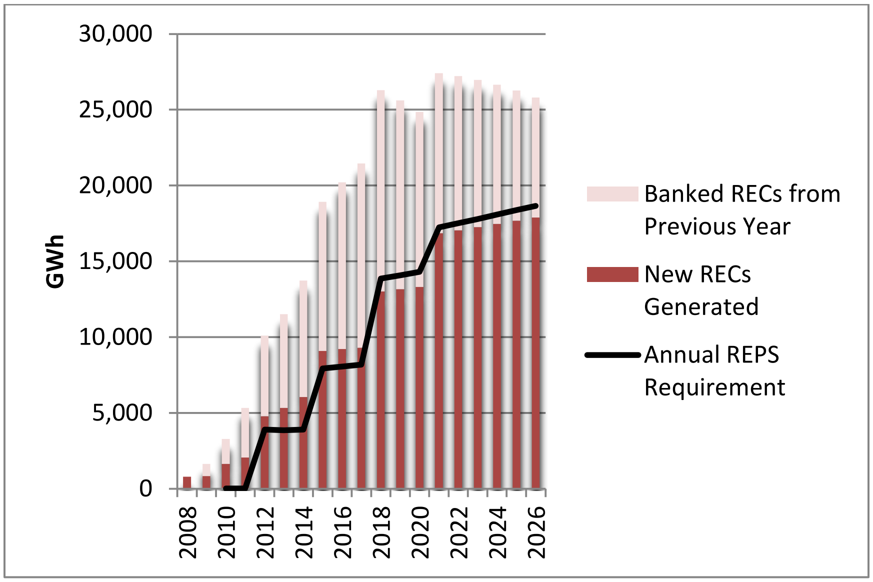
Figure 4-1. Projected Clean Energy Portfolio Output by Source (in GWh)



The amount of banked certificates grows larger through 2017 as annual production of RECs exceeds the annual REPS requirement. This banking provision is generous relative to those found in other states with renewable portfolio standards and helps mitigate potential rate increases.

Figure 4-2 shows projected combined REPS compliance for all utilities through 2026 with the Clean Energy Portfolio. The banking provisions underlying the REPS allow utilities to build facilities now and “bank” the certificates for use in a future compliance period. As a result, production in 2008 to 2011 (when there were no compliance requirements) could be used for later years’ compliance. The amount of banked certificates grows larger through 2017 as annual production of RECs exceeds the annual REPS requirement. This banking provision is generous relative to those found in other states with renewable portfolio standards and helps mitigate potential rate increases.

Figure 4-2. Projected Combined REPS Compliance for All Utilities through 2026



4.3 DEVELOPING CONVENTIONAL PORTFOLIO ALTERNATIVE

We developed a Conventional Portfolio alternative to the Clean Energy Portfolio by assuming that no renewable energy resources are built as a result of REPS and no energy efficiency measures are initiated after 2007. The energy that is assumed to be generated or saved by these resources in the Clean Energy Portfolio is replaced by a least-cost portfolio of conventional resources. We assumed that biomass co-fire generation and nondispatchable renewable generation[13] would be replaced by additional dispatch at existing coal plants, which adds further conservatism to our cost estimates of the Conventional Portfolio. **Table 4-3** provides a summary comparison of the Clean Energy and Conventional Portfolios. Because the analysis is based on a levelized cost approach, we did not make any assumption about capacity (MW) build-out in the Conventional Portfolio.

[13] Hydropower is included with “nondispatchable” renewable generation on the assumption that small units have limited pondage and therefore limited ability to moderate output at the request of the grid operator.

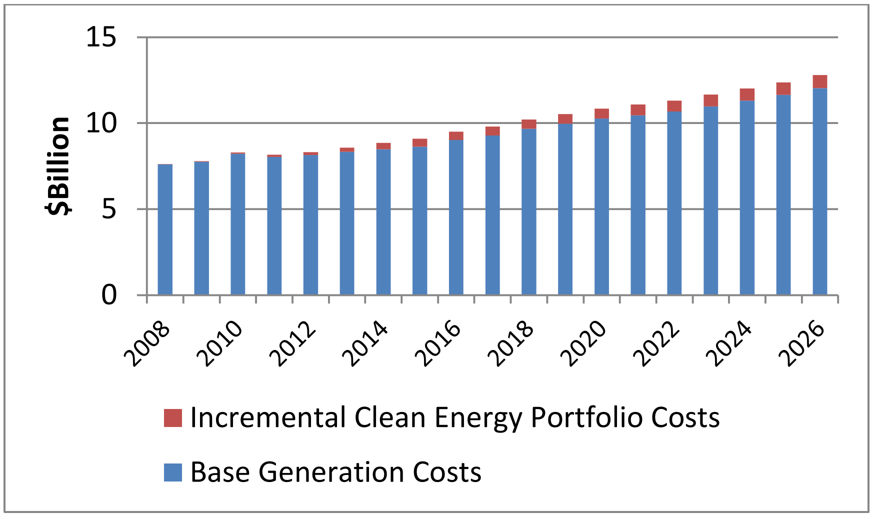
Table 4-3. Comparison of Incremental Clean Energy and Conventional Portfolios by Key Sources of Output

Clean Energy Portfolio	Conventional Portfolio
Pre–2008 renewable resources	Pre–2008 renewable resources
New renewable resources added since 2008: ▪ Dedicated biomass ▪ Landfill gas ▪ Poultry/swine waste	New gas combined-cycle combustion turbine (CCCT)
New renewable resources added since 2008: ▪ Wind ▪ Solar PV ▪ Hydropower ▪ Biomass co-fire	Additional coal dispatch
Energy efficiency savings	New gas CCCT
Thermal RECs	Not replaced
Out-of-state RECs	Not replaced

4.4 ESTIMATING INCREMENTAL PORTFOLIO COSTS

We estimated the annual cost of the incremental portfolios by multiplying the assumed annual output (or savings) from each resource type by the levelized cost for the resource type in the year it came online. The sum of levelized costs for all resources online in a given year is the incremental generation cost of the portfolio. We estimated total North Carolina generation supply costs using the latest Department of Energy projections (Energy Information Administration [EIA], 2012) for the Virginia/Carolinas region. **Figure 4-3** shows that the incremental cost of the Clean Energy Portfolio is a very small portion of the total generation costs needed to serve North Carolina's electricity needs.

Figure 4-3. Total Generation Costs with Clean Energy

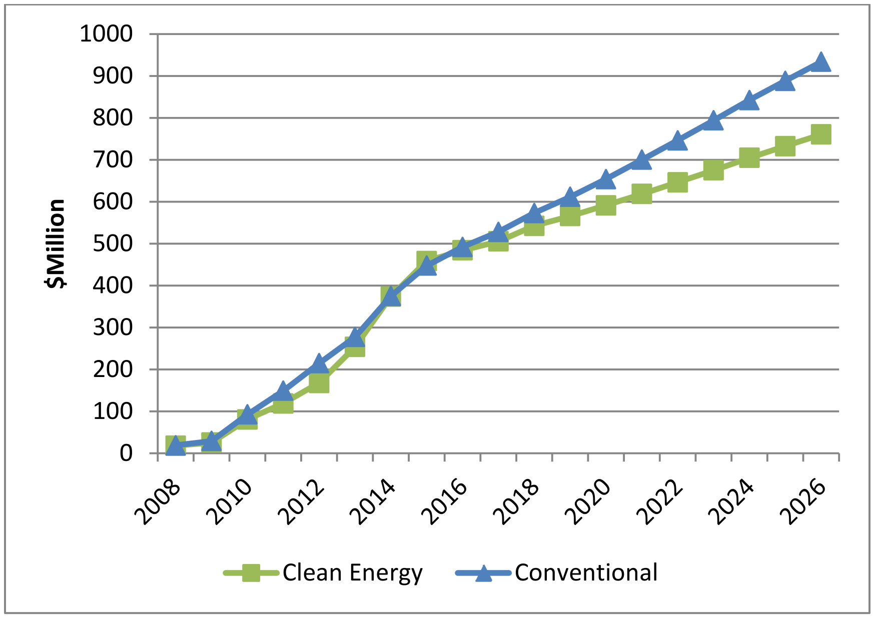


It is important to note that the red bar in **Figure 4-3** does not represent the rate impact of clean energy policies. Rather, the red bar represents the cost of the incremental production associated with clean energy policies. These costs would not go away in the absence of clean energy policies because this production would have to be replaced by other resources, which we show in the next figure.

By 2026, the Clean Energy Portfolio provides about $173 million in generation cost savings compared with the Conventional Portfolio.

Figure 4-4 compares the incremental costs of the Clean Energy Portfolio and the Conventional Portfolio. The costs of the two portfolios are quite similar through 2016, but thereafter the Clean Energy Portfolio begins to show a lower cost trajectory than the Conventional Portfolio. By 2026, the Clean Energy Portfolio provides about $173 million in generation cost savings compared with the Conventional Portfolio. These cost savings are largely due to expansion of energy efficiency programs, which are forecasted to continue to be cost-effective compared with existing, conventional supply resources.

Figure 4-4. Generation Cost Comparison of Incremental Clean Energy and Conventional Portfolios



4.5 RATE IMPACT ANALYSIS

The rate impact of the Clean Energy Portfolio compared with the Conventional Portfolio was calculated by dividing the difference in total generation costs by projected North Carolina retail sales. The result is an estimate of the cents per kilowatt-hour impact customers can expect to see in their bills as a direct result of clean energy policies. As shown in **Figure 4-5**, in all but a few years customers can expect savings in the generation portion of their electric bills as a result of clean energy policies such as REPS, state and federal tax credits, and energy efficiency incentives. For a typical North Carolina residential customer,[14] the monthly savings amount to almost $0.50 in 2012 and more than $1.00 by 2024.

[14] Based on EIA (2011) data showing the typical North Carolina residential customer uses 1,151 kWh of electricity per month.

Figure 4-5. Clean Energy Rate Impact (in cents per kWh) Compared with Conventional Portfolio

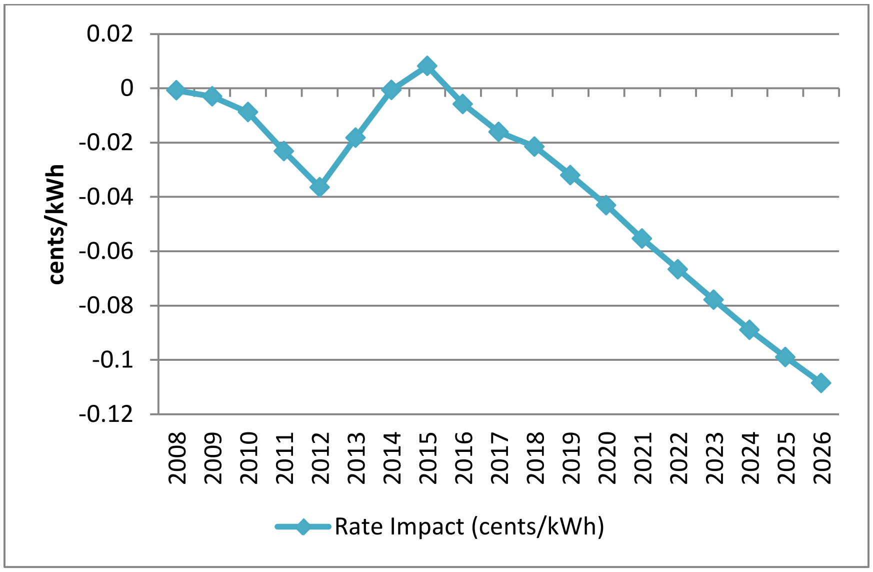
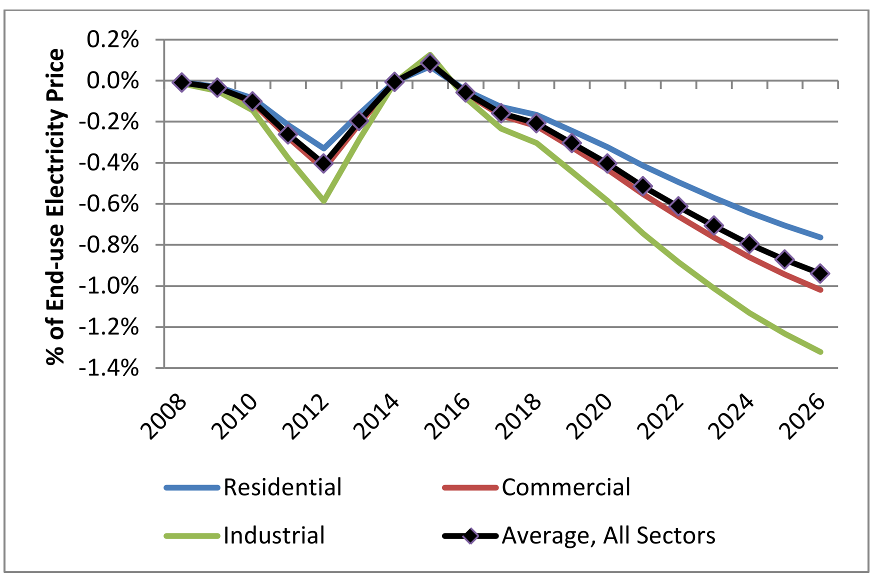


Figure 4-6 shows the expected rate impact as a percentage of total end-use electricity costs for various customer classes.[15] Rate impacts as a percentage of supply prices are greatest for industrial customers because industrial customers enjoy lower per-kWh rates than commercial and residential customers (as defined by EIA).

Figure 4-6. Clean Energy Portfolio Rate Impact (as a percentage of end-use electricity price) Compared with Conventional Portfolio



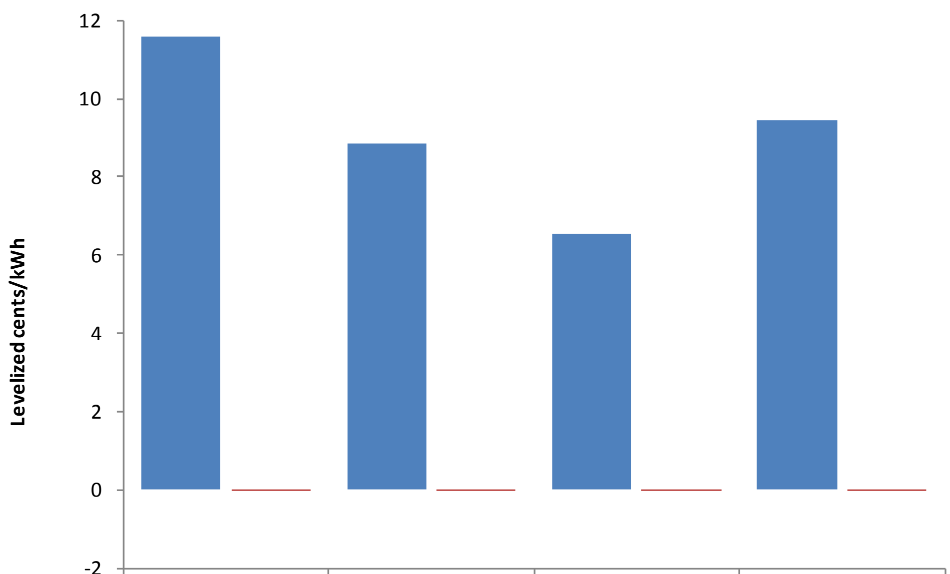
[15] End-use electricity cost projections for the Virginia/Carolinas region from the 2013 Annual Energy Outlook (Early Release) (EIA, 2012).

The data show that over the 20-year period since the start of clean energy policies in North Carolina, rates are expected to be lower than they would have been had North Carolina continued to only use existing, conventional generation sources.

Figure 4-7 shows a comparison in levelized cents per kilowatt-hour of the clean energy rate impact to total projected end-use electricity prices over the 2008 to 2026 study period. The data show that over the 20-year period since the start of clean energy policies in North Carolina, rates are expected to be lower than they would have been had North Carolina continued to only use existing, conventional generation sources. This result is primarily due to the specific design elements of REPS and other clean energy policies and the utilities' plans for expansion of energy efficiency.

Overall, we conclude that the rate impact of clean energy policies is quite minor, and, based on the assumptions in our analyses, generally results in savings for North Carolina ratepayers over the study period. Of course, changes in certain assumptions, such as the specific renewable build-out and availability of energy efficiency, will affect the actual rate impacts, but even accounting for possible changes in these values, it appears that the REPS, as currently enacted and implemented to date, leads to no appreciable rate impact on North Carolina ratepayers.

Figure 4-7. Levelized Clean Energy Portfolio Rate Impact Compared with Cost of Electricity by Customer Class (2008–2026 levelized cents/kWh)



	Residential	Commercial	Industrial	All Sectors Average
Levelized End-use Electricity Price	11.58	8.85	6.53	9.45
Levelized Clean Energy Rate Impact	-0.02	-0.02	-0.02	-0.02

References

Energy Information Administration (EIA). 2011. How Much Electricity Does an American Home Use? http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3. Accessed January 30, 2013.

Energy Information Administration (EIA). 2012. AEO2013 Early Release Overview. http://www.eia.gov/forecasts/aeo/er/index.cfm.

National Renewable Energy Laboratory (NREL). 2010. *Cost and Performance Assumptions for Modeling Electricity Generation Technologies*. http://www.nrel.gov/docs/fy11osti/48595.pdf.

North Carolina Department of Commerce. November 26, 2012. “2012 Utility Savings Initiative (USI) Annual Report.”

North Carolina Department of Revenue. Policy Analysis and Statistics Division, unaudited NC-478G. 2007-2011.

U.S. Department of Energy. Database of State Incentives for Renewables and Efficiency. Summary Maps. http://www.dsireusa.org/summarymaps/index.cfm?ee=1&RE=1.

U.S. Energy Information Administration. 2013. “Electric Power Monthly.” http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a. Accessed January 15, 2013.

Appendix A: Technical Appendix

A.1 RENEWABLE TECHNOLOGY DATA SOURCES AND ASSUMPTIONS

A.1.1 Photovoltaic Solar

Installed photovoltaic (PV) capacity between 2007 and 2012 was estimated based on data from NC-RETS (North Carolina Renewable Energy Tracking System, 2012), NC GreenPower (North Carolina GreenPower, 2012), and three additional systems totaling 16.48 MW not in these data sets verified via a press release (Duke Energy, 2013) and personal communication with project developers. Energy generated was estimated by applying a capacity factor of 19%, based RTI's review of 2011 PV generation in North Carolina (EIA, 2011) and PVWattv2 (NREL, 2012b).

Because of the magnitude of PV relative to other clean energy projects and the rapid decline in the cost of PV installations over the time period (NREL, 2012a), we developed cost estimates for installations by size of system and year of installation. NCSEA provided RTI with a database of publicly-available registered renewable systems, including size and cost where available. For systems in the database with capacity not specified as AC, RTI converted from DC to AC by applying a derate factor of 0.79. RTI independently reviewed several registrations to verify values within the database against NCUC dockets, and further cleaned the data by removing outliers (removing values 1.5x the interquartile range below the first and above the third quartile for each year). Costs for each year were then adjusted to 2011$ using the CPI (BLS, 2012). Table

A-1 shows RTI's estimates of the average cost per kW (AC), which are consistent with other available PV cost data sources over the study period. Annual fixed O&M costs are assumed to be $26/kW (Table 4-1).

Table A-1. Average Cost for Solar Photovoltaic Installations by Year and Size (AC kW, 2011$)

Expected Year Online	< 10kW	10 kW – 100kW	100 kW – 1 MW	1MW – 2MW	> 2MW
2006	17,619				
2007	13,031	11,155			
2008	11,948	11,150	12,564		
2009	10,714	9,863	7,357		
2010	9,047	7,885	6,554	5,524	
2011	8,006	6,765	5,952	5,634	3,781
2012	7,551	6,183	5,067	4,606	3,991

A.1.2 Landfill Gas

Capacity for landfill gas (LFG) facilities was estimated using data from NC-RETS (North Carolina Renewable Energy Tracking System, 2012) and modified based on personal communication for one facility. We estimated generation by LFG facilities based on EIA 2011 generation data (EIA, 2011) where available, and otherwise applied a uniform capacity factor (Table 4-1). Installation and O&M costs were also based on uniform estimates (Table 4-1) with the exception of personal communication regarding installation costs for one facility.

A.1.3 Hydroelectric

We estimated new or incremental capacity at hydroelectric facilities between 2007 and 2012 from NC-RETS (North Carolina Renewable Energy Tracking System, 2012), EIA data (EIA, 2011), and NCUC registrations (Duke, 2012; Kleinschmidt, N/A; Brooks Energy, 2008; Advantage Investment Group LLC, 2004; Cliffside Mills LLC, 2008; Madison Hydro Partners, 2010). Installation cost, O&M cost and capacity factor assumptions are shown in Table 4-1.

A.1.4 Biomass

Capacity for biomass facilities installed between 2007 and 2012 was estimated using data from NC-RETS (North Carolina Renewable Energy Tracking System, 2012) and adjusted to reflect data in NCUC registrations for two facilities (EPCOR USA, 2009). Capacity for co-fired facilities was adjusted to reflect the 2011 fraction of renewable fuel consumed (EIA, 2011). We estimated generation by biomass facilities based on EIA 2011 generation data (EIA, 2011) where available, and otherwise applied a uniform capacity factor (Table 4-1). Installation, O&M and fuel costs were based on uniform estimates (Table 4-1) or reported costs in NCUC dockets or press releases where available (Capital Power, 2011; Coastal Carolina Clean Power LLC, 2008; Prestage Farms Incorporated, 2011).

A.1.5 Biomass Combined Heat and Power

Thermal output capacity at biomass combined heat and power (CHP) facilities were developed from NC-RETS (North Carolina Renewable Energy Tracking System, 2012) and NCUC registrations for two facilities (EPCOR USA, 2009). Capacity for co-fired facilities was adjusted to reflect the 2011 fraction of renewable fuel consumed (EIA, 2011). For CHP facilities in the EIA-923 database, capacity was further adjusted to reflect the fraction of heat generated used for electricity. We estimated generation by biomass facilities based on EIA 2011 generation data (EIA, 2011) where available, and otherwise applied a uniform capacity factor (Table 4-1). Costs of these facilities are incorporated in the biomass cost estimates discussed above.

A.1.6 Wind

Wind power installations were developed from NC-RETS (North Carolina Renewable Energy Tracking System, 2012). Capacity factor and installation and O&M costs were based on uniform estimates (Table 4-1) or reported costs in NCUC dockets or press releases where available (ASU News, 2009; Madison County School System, 2009).

A.1.7 Solar Thermal Heating

Estimates of solar thermal heating capacity installed between 2007 and 2012 are based on data reported in NC-RETS (North Carolina Renewable Energy Tracking System, 2012). RTI reviewed publicly available sources of project installation costs, annual energy generation and system O&M (North Carolina Department of Commerce, 2010; NREL, 2011a) to develop the assumptions that solar thermal systems cost $3500/kW to install and $60/kW of annual O&M. Installation costs for one project were taken from a news report (News and Observer, 2012). We assume that solar thermal heating systems have the same capacity factor as PV systems.

A.1.8 Geothermal Heat Pumps

Geothermal heat pump capacity is not reported in NC-RETS. The North Carolina Department of Environment and Natural Resources (NCDENR) provided permit data for geothermal wells (NCDENR, personal communication, January 11, 2013). While the number of wells per system varies based on system type and local conditions, given the available data, we assumed that a typical 3 ton system in North Carolina required 5 wells to convert wells to system size based on a project case study (Bosch Group, 2007). Based on personal communication with geothermal system contractors in North Carolina, we assume the cost of an average 3 ton system to be $20,000. Due to lack of suitable publicly-available data in North Carolina, conversion of system tons to kW and annual energy savings per ton were estimated from available project data for a large installation in Louisiana (NREL, 2011b). O&M cost per year are assumed to be $35/kW (IEA, 2010).

A.1.9 Passive Solar

Passive Solar tax credit spending data from the Department of Revenue (NC Department of Revenue, 2007–2011) is the only available data for passive solar projects over the study period. Installed capacity and energy savings were estimated based on publicly-available passive solar cost and energy savings data (Oregon Department of Energy, 2012) and the assumption that all projects received the full state tax credit for their project costs.

A.1.10 State Incentives for Renewable Energy

Tax credits taken for 2007 through 2011 were developed from figures provided by the NC Department of Revenue (NC Department of Revenue, 2011). We estimated the 2012 tax credits taken assuming that all renewable investment estimated in 2012 would generate tax credits at the same ratio of tax credits generated to the value of renewable property claimed in 2011 (30%) and that 20% of all credits generated between 2008 and 2012 would be taken in 2012.

A.1.11 Spending Changes from Renewable Energy Generation

We applied the following assumptions to estimate spending changes resulting from energy generated at renewable energy facilities. For electricity produced by renewable facilities, we assume that renewable project owners receive the avoided cost of electricity net of O&M and fuel costs that would be otherwise spent on conventional energy generation. Based on a review of avoided cost schedules for qualifying facilities from Duke and Progress (Duke Energy, 2012b; Progress, 2012), we apply the simplifying assumption that the avoided cost paid to all renewable facilities is $60/MWh.

For non-electric renewable energy, we assume that the energy saved results in a reduction in retail energy spending. For biomass thermal generation at CHP facilities, we assume the cost of energy saved as the industrial retail price for electricity, $68.20/MWh (EIA, 2013). For geothermal, solar thermal, and passive solar, we assume that the cost of energy saved is the average retail price for electricity, $99/MWh (EIA, 2013).

Total REPS rider charged to customers over the study period was taken from NCUC dockets (Duke Energy, 2009b; Duke Energy, 2010a; Duke Energy, 2011a; Progress, 2009a; Progress, 2010a; Progress, 2011a; Progress, 2012; GreenCo, 2010a; GreenCo, 2010c; GreenCo, 2012a; GreenCo, 2012b; NCMPA1, 2011; NCMPA1, 2012; NCEMPA, 2009; NCEMPA, 2010; NCEMPA, 2012), and included in the analysis as a change in spending to project owners from utility customers.

A.2 ENERGY EFFICIENCY DATA SOURCES AND ASSUMPTIONS

A.2.1 Utility Programs

Energy efficiency program costs were taken from the start of the program until 2012 (Dominion North Carolina Power, 2010; Dominion North Carolina Power, 2011; Dominion North Carolina Power, 2012), Duke (Duke Energy, 2009a; Duke Energy, 2010b; Duke Energy, 2011b), NC GreenCo (GreenCo, 2010b), NCMPA (ElectriCities 2010; ElectriCities, 2011; ElectriCities, 2012), and Progress (Progress, 2009b; Progress, 2009c; Progress, 2010b; Progress, 2010c; Progress, 2011b; Progress, 2011c). Demand-Side management program costs were only included for 2011 and 2012 because these programs could not pass along costs to consumers until 2011 (General Assembly, 2011).

Energy savings associated with utility programs between 2007 and 2011 was estimated based on NC-RETS data (NC-RETS, 2012). Energy savings from utility programs in 2012 was estimated from expected 2012 savings from NCUC dockets (Duke Energy, 2011, Progress, 2011b, GreenCo, 2010c). We assumed that the change in spending associated with these energy savings is equal to the avoided cost of electricity, $60/MWh, and is distributed evenly between the utilities and utility customers, consistent with cost savings under Duke's Save-A-Watt program (Duke Energy, 2009a).

A.2.1 Utility Savings Initiative

Data on the cost, savings, and incentives for the Utility Savings Initiative was taken from the project's 2012 annual report (NC Department of Commerce, 2012).

A.3 IMPLAN ANALYSIS

We distributed spending for each renewable facility, efficiency program, government incentive and change in spending resulting from renewable energy generation and energy savings across IMPLAN sectors based on distributions in other comparable reports and models where appropriate (NREL, 2012c; NREL, 2012d; Regulatory Assistance Project, 2005; Bipartisan Policy Center, 2009), 2011 IMPLAN default data for North Carolina (MIG Inc., 2012), and original assumptions where necessary (Table A-2).

Three breakouts were developed using IMPLAN default data to model additional spending or savings to utility customers. First, Post-Tax Consumer Income was created using the proportion of money spent and from consumers. Second, Corporate Net Income was created using the proportion of money spent, saved and taxed from corporations. Third, State Spending was developed using the three categories that IMPLAN has for state spending: Investment, Education and Non-Education. Dollars not spent by the state were deducted based on the proportion of state spending in these three categories.

Table A-2. IMPLAN Breakout for Renewable Energy, Energy Efficiency and State Spending

Type	Direct Spending	Secondary Effects
Renewable Energy		
Solar Photovoltaic	Investment spending was allocated across IMPLAN sectors using the default breakout in JEDI PV model (NREL, 2012c) according to the installation size.	The avoided cost of energy produced was transferred to Sector 366, Lessors of non-financial intangible assets (Regulatory Assistance Project, 2005) from inputs to Sector 31, Electricity, generation, transmission, and distribution.
Hydroelectric	Investment spending was allocated to IMPLAN Sector 36, Construction of other new nonresidential structures.	Avoided cost net of fixed and variable O&M costs was transferred to Sector 366, Lessors of non-financial intangible assets (Regulatory Assistance Project, 2005) from inputs to Sector 31, Electricity, generation, transmission, and distribution. Fixed and variable O&M was allocated to IMPLAN Sector 39, Maintenance and repair construction of non-residential structures.
Wood Biomass	Investment spending was allocated based on the Wood Biomass IMPLAN distribution in the 2009 Bipartisan Policy Center report,	Avoided cost of energy produced net of fuel, fixed O&M and variable O&M costs was transferred to Sector 366, Lessors of non-financial intangible assets (Regulatory Assistance Project, 2005) from inputs to Sector 31, Electricity, generation, transmission, and distribution. Fixed and variable O&M costs were allocated based on the Wood Biomass IMPLAN distribution in the 2009 Bipartisan Policy Center. Fuel costs were allocated to Sector 15, Forestry, forest products, and timber tract production
Biomass Co-Fire	Investment spending was allocated based on the Biomass Co-Fire IMPLAN distribution in the 2009 Bipartisan Policy Center report.	Avoided cost net of fuel, fixed O&M and variable O&M costs were transferred to Sector 366, Lessors of non-financial intangible assets (Regulatory Assistance Project, 2005) from inputs to Sector 31, Electricity, generation, transmission, and distribution. Fixed and variable O&M costs were allocated based on the Biomass Co-Fire IMPLAN distribution in the 2009Bipartisan Policy Center report. Fuel costs were allocated to Sector 15, Forestry, forest products, and timber tract production

(continued)

Table A-2. IMPLAN Breakout for Renewable Energy, Energy Efficiency and State Spending (continued)

Type	Direct Spending	Secondary Effects
Renewable Energy (cont.)		
Swine Biomass	Investment spending was allocated based on the Swine Biomass IMPLAN distribution in the 2009 Bipartisan Policy Center report.	Avoided cost net of fixed O&M and variable O&M costs were transferred to Sector 366, Lessors of non-financial intangible assets (Regulatory Assistance Project, 2005) from inputs to Sector 31, Electricity, generation, transmission, and distribution. Fixed and variable O&M costs were allocated based on the Swine Biomass IMPLAN distribution in the 2009 Bipartisan Policy Center report.
Wind	Investment spending was allocated across IMPLAN sectors using the default breakout in JEDI Wind model (NREL, 2012d).	The avoided cost of energy net of fixed O&M produced was transferred to Sector 366, Lessors of non-financial intangible assets (Regulatory Assistance Project, 2005) from inputs to Sector 31, Electricity, generation, transmission, and distribution. Fixed O&M costs were allocated across IMPLAN sectors using the default breakout in JEDI Wind model (NREL, 2012d).
Landfill Gas	Investment spending was allocated based on the Landfill Gas IMPLAN distribution in the 2009 Bipartisan Policy Center report.	The avoided cost of energy produced net of fixed O&M costs was transferred to Sector 366, Lessors of non-financial intangible assets (Regulatory Assistance Project, 2005) from inputs to Sector 31, Electricity, generation, transmission, and distribution. Fixed O&M costs were allocated based on the Landfill Gas IMPLAN distribution in the 2009 Bipartisan Policy Center report.
Geothermal Heat Pumps	Investment spending was allocated 50% to Sector 216, Air Conditioning, Refrigeration, and Warm Air Heating Equipment Manufacturing, 25% to Sector 36, Construction of Other New Non-Residential Structures and 25% to Sector 319, Wholesale Trade.	The retail cost of energy saved net of O&M costs was transferred 70% to Corporate Net Income and 30% to Post-Tax Consumer Spending (assuming systems with 10 or fewer wells were for residential customers, and those with more were commercial customers) from Sector 31, Electricity, generation, transmission, and distribution. Fixed O&M costs were allocated to IMPLAN Sector 39, Maintenance and repair construction of non-residential structures.
Passive Solar	Investment spending was allocated to Sector 37, Construction of new residential permanent site single and multi-family structures.	The retail cost of energy saved was transferred to Post-Tax Consumer Spending from Sector 31, Electricity, generation, transmission, and distribution.

(continued)

Table A-2. IMPLAN Breakout for Renewable Energy, Energy Efficiency and State Spending (continued)

Type	Direct Spending	Secondary Effects
Renewable Energy (cont.)		
Solar Thermal	Investment spending was allocated across IMPLAN sectors using PV breakout for 100 kW-1 MW systems from JEDI PV model (NREL, 2012c).	The retail cost of energy saved net of O&M costs was transferred to Corporate Net Income from Sector 31, Electricity, generation, transmission, and distribution. Fixed O&M costs were allocated to IMPLAN Sector 39, Maintenance and repair construction of non-residential structures.
REPS Rider		REPS rider was transferred to Sector 366, Lessors of non-financial intangible assets (Regulatory Assistance Project, 2005) from a split of 50% from Corporate Net Income for commercial and industrial customers and 50% from Post-Tax Consumer Spending for residential customers.
Efficiency Programs		
Utility Programs	Efficiency program investments were allocated to IMPLAN sectors according to the 2005 Regulatory Assistance Project report breakouts for the following categories: Residential Retrofit, Residential New Construction, Commercial Retrofit and Commercial New Construction. In addition, for residential appliance recycling program, we distributed investment spending 10% to Sector 390, Waste Management and Remediation Services, and 90% to Sector 319, Wholesale Trade Businesses. For school education programs, we distributed spending across 100% to Sector 380, All other miscellaneous professional, scientific and technical services.	The avoided cost of energy saved was transferred 50% to Sector 366, Lessors of non-financial intangible assets for utility recovery of avoided costs, 25% to Corporate Net Income for industrial and commercial customer savings and 25% to Post-Tax Consumer Spending for residential customer savings from inputs to Sector 31, Electricity, generation, transmission, and distribution.
Utility Savings Initiative	USI program investments were allocated to IMPLAN sectors according to the Commercial Retrofit category in the 2005 Regulatory Assistance Project report.	USI savings transferred to State Spending and taken from Sector 31, Electricity, generation, transmission, and distribution.
Government Initiatives		
Tax Credit		Tax credit deducted from IMPLAN State Spending breakout.
Utility Savings Initiative		USI appropriations deducted from IMPLAN State Spending breakout.

A.4 REFERENCES

Advantage Investment Group LLC. (2004). “Application to Transfer Spencer Mountain Hydroelectric Station.” SP-143 Sub 0. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

ASU News. (2009). “Appalachian Installs Wind Turbine on Campus.” Available at http://www.news.appstate.edu/2009/06/24/wind-turbine-on-campus/. Accessed January 15, 2013.

Bipartisan Policy Center. (2009). “Projected Impacts of Proposed Federal Renewable Energy Portfolio Standards on the North Carolina Economy.”

Bosch Group. 2007. “Green Home Raleigh.” Available at http://www.fhp-mfg.com/?p=view_case_study&n=7 Accessed January 15, 2013.

Brooks Energy. (2008). “Registration Statement.” SP-140 Sub 1. http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 15, 2012.

Capital Power. (2011). “Capital Power Confirms Strategic Direction.” Available at http://www.capitalpower.com/MediaRoom/newsreleases /2011-news-releases/Pages/062011.aspx. Accessed January 15, 2013

Cliffside Mills LLC. (2008). “Registration Statement.” SP-147 Sub 1. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Coastal Carolina Clean Power LLC. (2008). “Petition to Construct a Cogeneration Plant in Duplin Co. & Petition for Renewable Energy Facility.” SP-161 Sub 1. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Dominion North Carolina Power (2010). “Application for Approval of a Cost Recovery Rider for Demand Side Mgmt./ Energy Efficiency Measures.” E-22 Sub 464. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

Dominion North Carolina Power (2011). "Application for Approval of Cost Recovery for Demand-Side Management & Energy Efficient Program." E-22 Sub 473. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

Dominion North Carolina Power (2012). "Dominion's Application for Approval of Cost Recovery for Demand-side Management & Energy Efficiency." E-22 Sub 486. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

Duke Energy Carolinas, LLC. (2009a). "Agreement and Joint Stipulation of Settlement." E-7 Sub 831. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Duke Energy Carolinas, LLC. (2009b). "Renewable Energy and Energy Efficiency Portfolio Standards." E-7 Sub 872. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Duke Energy Carolinas, LLC. (2010a). "Application for Approval of REPS Cost Recovery." E-7 Sub 936. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Duke Energy Carolinas, LLC. (2010b). "Application for Approval of DSM/EE Rider." E-7 Sub 1001. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Duke Energy Carolinas, LLC. (2011a). "Duke Energy's 2010 REPS Compliance Report and Application for Approval of REPS Cost Recovery." E-7 Sub 984. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Duke Energy Carolinas, LLC. (2011b). "Duke's Application-Approval of DSM/Energy Efficiency Cost Recovery Rider." E-7 Sub 977. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Duke Energy Carolinas, LLC. (2012a). "Application for Approval of Vintage 4 Rider EE, Testimony and Exhibits (Part 4)." E-7 Sub 1001. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Duke Energy Carolinas, LLC. (2012b). "Duke's REPS Cost Recovery Rider and 2011 REPS Compliance Report." E-7 Sub 1008. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 22, 2013.

Duke Energy. (2012). "Bridgewater HyrdroelectricHydroelectric Station." Available at http://www.duke-energy.com/pdfs/Bridgewater-Hydroelectric-Station.pdfhttp://www.duke-energy.com/pdfs/Bridgewater-Hydroelectric-Station.pdf. Accessed January 15, 2013.

Duke Energy. 2013. "Duke Energy Renewables Completes Solar Farm in Eastern N.C." Jan. 10, 2013. Available at http://www.duke-energy.com/news/releases/2013011001.asp. Accessed February 12, 2013.

ElectriCities (2010). "North Carolina Eastern Municipal Power Agency 1's 2009 Compliance Report." E-100 Sub 129. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

ElectriCities (2011). "NCMPA1's 2010 REPS Compliance Report." E-100 Sub 131. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

ElectriCities (2012). "NCMPA1's 2011 REPS Compliance Report - Public Version." E-100 Sub 135. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

EPCOR USA North Carolina, LLC. 2009. "Order Issuing Amended Certificates, Accepting Registration Statement, and Issuing Declaratory Ruling." Docket SP-165 Sub 3. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 20, 2013.

General Assembly of North Carolina. (2011). Session Law 2011-55. "Senate Bill 75: An Act to Promote the Use of Electricity Demand Reduction to Satisfy Renewable Energy Portfolio Standards." Available at http://www.ncleg.net/Sessions/2011/Bills/Senate/PDF/S75v4.pdf. Accessed on January 15, 2013.

GreenCo (2010a). "2008 REPS Compliance Reports." EC-83 Sub 1. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

GreenCo (2010b). "Amended Energy Efficiency Approval Requests." EC-83 Sub 0. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

GreenCo (2010c). "Investigation of Integrated Resource Planning in NC-2010." E-100 Sub 128. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

GreenCo (2012a). "2012 REPS Compliance Plans & 2011 REPS Compliance Reports." E-100 Sub 135. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

GreenCo (2012b). "2012 Biennial Integrated Resource Plans and Related 2012 REPS Compliance Plans." E-100 Sub 137. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed November 1, 2012.

IEA Energy Technology Network. (2010). "Technology Brief E07: Geothermal Heat and Power."

Kleinschmidt. "Jordan Hydroelectric Project." Available at http://www.kleinschmidtusa.com/projects/hydro-engineering/jordan-hydroelectric-project/. Accessed January 15, 2013.

Madison County School System. (2009). "Report of Proposed Construction & Registration Statement for 2.4 kW Grid Tied Turbine." SP-432 Sub 1. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Madison Hydro Partners. (2010). "Registration Statement for Hydroelectric Facility Named Ivy River Dam." SP-781 Sub 0. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

MIG, Inc., (2012). "IMPLAN System: Software North Carolina 2011 Data." 1725 Tower Drive West, Suite 140, Stillwater, MN 55082 www.implan.com.

National Renewable Energy Laboratory. (2012a). "Tracking the Sun V: A Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2011." Available at http://eetd.lbl.gov/sites/all/files/publications/lbnl-5919e-report.pdf. Accessed December 4, 2011.

National Renewable Energy Laboratory. (2012c) “Jobs and Economic Development Solar Photovoltaic Model.” Available at http://www.nrel.gov/analysis/jedi/. Accessed December 4, 2011.

National Renewable Energy Laboratory. (2012d) “Jobs and Economic Development Wind Model.” Available at http://www.nrel.gov/analysis/jedi/. Accessed December 4, 2011.

National Renewable Energy Laboratory. (2011a). “Break-Even Cost for Residential Solar Water Heating in the United States: Key Drivers and Sensitivities.” Available at http://www.nrel.gov/docs/fy11osti/48986.pdf. Accessed January 15, 2013.

National Renewable Energy Laboratory. (2011a). “A Broad Overview of Energy Efficiency and Renewable Energy Opportunities for Department of Defense Installations.” Available at http://www.nrel.gov/docs/fy11osti/50172.pdf. Accessed January 22, 2013.

National Renewable Energy Laboratory. (2012b). “PVWatts Grid Data Calculator (Version 2).” Available at http://www.nrel.gov/rredc/pvwatts/grid.html. Accessed January 15, 2013.

NCEMPA. (2009). “2009 REPS Compliance Plans and 2008 REPS Compliance Reports.” E-100 Sub 125. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

NCEMPA. (2010). “2010 REPS Compliance Plans and 2009 REPS Compliance Reports.” E-100 Sub 129. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

NCEMPA. (2012). “2010 REPS Compliance Plans and 2009 REPS Compliance Reports.” E-100 Sub 135. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

NCMPA1. (2011). “2011 REPS Compliance Plans and 2010 REPS Compliance Reports.” E-100 Sub 131. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

NCMPA1. (2012). “2012 REPS Compliance Plans & 2011 REPS Compliance Reports.” E-100 Sub 135. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

News and Observer. (2012). “Company Building Gigantic Solar Water Heating System at Turkey Plant.” Available at http://www.newsobserver.com/2012/03/24/1955756/nc-company-building-gigantic-solar.html. Accessed January 15, 2013.

North Carolina Department of Commerce. (2010) “Recovery Act Funds Support Innovative N.C. Energy Projects.” May 27, 2010.Available at http://www.thrivenc.com/newsandevents/recovery-act-funds-support-innovative-nc-energy-projects. Accessed January 15, 2013.

North Carolina Department of Commerce. “2012 Utility Savings Initiative (USI) Annual Report.” November 26, 2012.

North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2011). “Unaudited NC-478G Forms.”

North Carolina GreenPower. Available at http://www.ncgreenpower.org/resources/generators.php. Accessed January 20, 2013.

North Carolina Renewable Energy Tracking System. Available at http://www.ncrets.org/. Accessed January 20, 2013.

North Carolina Utilities Commissions. (2012). “North Carolina Utilities Commissions Dockets.” Available at http://www.ncuc.net/docket.htm. Accessed January 15, 2013.

Oregon Department of Energy. “Basic Solar Information.” Available at http://www.oregon.gov/energy/RENEW/Solar/docs/BasicSolarInformation.pdf. Accessed January 15, 2013.

Prestage Farms Incorporated. (2011). “Report of Proposed Construction and Registration Statement.” SP-1209 Sub 0. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2009a). “Renewable Energy and Energy Efficiency Portfolio Standard Compliance Report.” E-2 Sub 948. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2009b). “PEC’s Supplemental Direct Testimony and Exhibits of Robert Evans.” E-2 Sub 951. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2009c). "Direct Testimony of Robert P. Evans and Supporting Documentation." E-2 Sub 951. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2010a). "2009 Annual REPS Compliance Report and Application for Approval of REPS Cost Recovery Rider." E-2 Sub 974. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2010b). "Application for Approval of DSM and Energy Efficiency Cost Recovery Rider." E-2 Sub 977. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2010c). "Progress Energy Carolinas, Inc.'s Supplemental Testimony and Exhibits of Robert P. Evans." E-2 Sub 977. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2011a). "Petition for Approval of REPS Cost Recovery Rider Per G.S. 62-133.8 & Comm. Rule R8-67." E-2 Sub 1000. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2011b). "Application for Approval of DSM and Energy Efficiency Cost Recovery Rider and Direct Testimony." E-2 Sub 977. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2011c). "PEC's Supplemental Direct Testimony and Exhibits of Robert P. Evans." E-2 Sub 977. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2012). "2012 Annual Renewable Energy and Energy Efficiency Portfolio Standard Compliance Report (REPS)." E-2 Sub 1020. Available at http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed January 15, 2013.

Regulatory Assistance Project. (2005). "Electric Energy Efficiency and Renewable Energy in New England: An Assessment of Existing Policies and Prospects for the Future."

Spray Cotton Mills. (2010). "Spray Cotton Mills' Annual Report." SP-107 Sub 1. Available at http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

U.S. Bureau of Labor Statistics. (2012). "Consumer Price Index All Urban Consumers." Available at http://www.bls.gov/cpi/#data. Accessed February 1, 2013.

U.S. Energy Information Administration. (2011a). Form EIA-923 Annual Electric Utility Database. Available at http://www.eia.gov/electricity/data/eia923/index.html. Accessed January 15, 2013.

U.S. Energy Information Administration. (2012). "Annual Energy Outlook." Available at http://www.eia.gov/forecasts/aeo/pdf/0383(2012).pdf. Accessed January 15, 2013.

U.S. Energy Information Administration. (2013) "Electric Power Monthly." Available at http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a. Accessed January 15, 2013.