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Economic Impact Analysis of Clean Energy Development in North Carolina—2014 Update

Prepared for

North Carolina Sustainable Energy Association
P.O. Box 6465
Raleigh, NC 27628

Prepared by

RTI International
3040 E. Cornwallis Road
Research Triangle Park, NC 27709

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Executive Summary

This report presents an update to the retrospective economic impact analysis of renewable energy and energy efficiency investment included in the 2013 report, *The Economic, Utility Portfolio, and Rate Impact of Clean Energy Development in North Carolina*, prepared by RTI International and LaCapra Associates (2013).

In this supplement to the 2013 report, the direct and secondary effects associated with major energy efficiency initiatives and the construction, operation, and maintenance of renewable energy projects (collectively, “clean energy development”) are analyzed to measure the magnitude of clean energy development’s contribution to North Carolina’s economy.

Changes in consumer, utility, and government spending patterns are analyzed, including

- investment in clean energy projects in North Carolina and their ongoing operation and maintenance,
- how renewable energy generation and energy savings from energy efficiency projects have changed spending on conventional energy generation,
- reductions in spending due to the utility rider renewable energy and energy efficiency performance standard, and
- government spending that would have been spent on other government services in the absence of state support for clean energy investment.

Our research findings are as follows:

- Approximately $2,672.5 million was invested in clean energy development in North Carolina between 2007 and 2013, which was supported, in part, by the state government at an estimated cost of $135.2 million. Clean energy projects were nearly 20 times as large as the state incentives for them.

- Renewable energy project investment in 2013 was $732.4 million, or nearly 42 times the $17.5 million investment observed in 2007.
- Total contribution to gross state product (GSP) was $2,971.5 million between 2007 and 2013 (see **Table ES-1**).
- Clean energy development supported 37,100 annual full-time equivalents (FTEs) from 2007 to 2013.
- Catawba, Davidson, Duplin, Person, and Robeson Counties experienced the greatest amount of investment—more than $100 million each between 2007 and 2013.
- Beaufort, Cabarrus, Columbus, Cleveland, Wake, and Wayne Counties each experienced between $50 million and $100 million between 2007 and 2013.

Table ES-1. Total Economic Impacts, 2007–2013

	Total Output[a] (Million, 2013$)	Gross State Product[b] (Million, 2013$)	Employment (Full-Time Equivalents)	Fiscal Impacts[c] (Million, 2013$)
Direct economic impact of clean energy development	$2,672.5	$1,579.0	18,423	$180.0
Direct economic impact from change in government spending[d]	−$109.5	−$94.0	−1,473	−$3.6
Secondary economic impact[e]	$2,147.7	$1,486.5	20,150	$55.6
Total economic impact	$4,710.8	$2,971.5	37,100	$232.0

[a] Total output refers to revenue received by North Carolina individuals and businesses. [b] GSP represents the total value added. [c] State support for clean energy projects is included in the analysis as an offset to output and is not reflected in the fiscal impact results. Note: Sums may not add to totals because of rounding. See Appendix A for details. [d] Direct economic impact from change in government spending refers to the in-state impact of $135.2 million in state clean energy incentives, less $25.7 million that, based on historical spending patterns, would have otherwise procured goods and services from out of state. [e] Secondary impacts represent spending changes resulting from renewable energy generation and energy savings and indirect and induced impacts associated with supply chain effects and increased labor income spending.

1 Introduction and Analysis Approach

Between 2007 and 2013, annual investment in clean energy development in North Carolina increased nearly 20-fold from $44.6 million to $889.1 million, of which $732.4 million (82%) was for renewable energy projects and $156.7 million (18%) was for major energy efficiency initiatives.

The total amount of energy generated or saved through renewable energy and energy efficiency programs amounted to 10.674 million MWh, which is sufficient to power nearly 985,000 homes for 1 year.[1]

Although the growth in energy generation from renewable sources has been documented in annual energy reports,[2] the economic impact of clean energy development—economic activity from construction, operation, maintenance, changes in energy use, and consequent changes in spending—on North Carolina's economy had not been comprehensively measured until the 2013 report, *The Economic, Utility Portfolio, and Rate Impact of Clean Energy Development in North Carolina*, prepared by RTI International and LaCapra Associates (2013).

This report updates the economic impact results to include 2013. Otherwise, the data and analysis methodology are unchanged.

This analysis was commissioned by the North Carolina Sustainable Energy Association, a professional and trade

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[1] The Energy Information Administration (EIA) estimates that in 2012 a U.S. residential utility customer consumed 10,837 kWh (or 10.837 MWh) per year. See EIA (2011). http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3.

[2] For more information on renewable energy generation in the United States, see EIA (2014) http://www.eia.gov/electricity/annual/?src=Electricity-f4.

association, which had no role in the preparation of the analysis or report apart from posing research questions, suggesting data sources, and reviewing drafts.

As in the 2013 report, the principal research question answered by this analysis is: *What are the comprehensive retrospective statewide economic and fiscal impacts of clean energy development?*

1.1 ANALYSIS APPROACH

The economic impact analysis contained herein uses methods that provide results about the proportion of North Carolina's economic activity directly and indirectly associated with clean energy development. Clean energy development is defined to include the construction, operation, and maintenance of renewable energy facilities and energy efficiency initiatives.

This retrospective analysis of clean energy development

- analyzed the most current data available from the North Carolina Utilities Commission (NCUC), North Carolina Renewable Energy Tracking System (NC-RETS), the North Carolina Department of Revenue, the North Carolina Department of Environment and Natural Resources, and the U.S. Energy Information Administration (EIA);
- measured spending for clean energy investments made in North Carolina over the 7-year period from 2007 through 2013 along multiple dimensions, including project value and megawatt capacity or equivalent;
- used a regional input-output (I-O) analysis to estimate the gross indirect (supply chain) and induced (consumer spending from increased labor income) impacts throughout the state economy resulting from those investments, including the impacts of reduced conventional energy generation and of government incentives over the study period; and
- presented the gross employment, fiscal, economic output, and valued added (gross state product [GSP]) impacts of clean energy development on North Carolina's economy.

Two categories of economic effects were considered.

1. Direct effects: Information was gathered to quantify the direct investment (expenditures) related to clean energy development over the period 2007 through 2013. The

following impact categories were in scope: investment in renewable energy and energy efficiency projects 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 combined with spending changes resulting from renewable energy generation and energy savings and modeled using a regional I-O model to measure the consequent indirect (supply chain) and induced (consumer spending) impacts resulting from clean energy development.

The first step yielded direct economic impacts, while the second step yielded secondary effects of the direct impacts. The total economy-wide impacts represent the combination of the two. Analysis results are presented as the cumulative impact from 2007 through 2013; therefore, results should not be interpreted as annual totals.

Unlike other studies, the analysis accounts for selected displacement effects such as

- reduced spending on conventional energy production,
- how households and businesses would have otherwise spent the utility rider for the renewable energy and energy efficiency performance standard, and
- how state government funding would have been spent in the absence of state incentives for clean energy.

However, the analysis does not consider the alternative uses for the investment dollars devoted to clean energy projects. As a result, the economic impact measures used in this report are best interpreted as gross versus net changes in state-level economic activity.[3]

It is also important to note that the selected methodology does not evaluate how North Carolina's clean energy incentives and policies influence investment or how state incentives/policy interact with other federal policy. Thus, for example, the methodology does not estimate the portion of investment that occurred as a result of state incentives; instead, it focuses on measuring gross changes in economic activity associated with all clean energy investment that took place over the study period.

[3] See also http://www.nrel.gov/analysis/jedi/limitations.html.

1.2 ABOUT RTI INTERNATIONAL

RTI International is one of the world's leading independent 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 nine offices in the United States and nine 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 2013, RTI's revenue was $783 million.

2 Economic Impacts, 2007–2013

From 2007 through 2013, $2,056.0 million was spent on construction and installation of renewable energy projects in North Carolina. An additional $616.5 million was spent on implementing energy efficiency programs.[4] Total clean energy development was valued at $2,672.5 million.

Although investment was distributed across the state, Catawba, Davidson, Duplin, Person, and Robeson Counties each experienced the greatest amount, with more than $100 million in renewable energy project investment each.

Clean energy development contributed $2,971.5 million in GSP and supported 37,100 annual FTEs statewide. As a result of changes in economic activity from the development of clean energy in North Carolina, state and local governments realized tax revenue of $232.0 million.

2.1 ESTIMATED DIRECT IMPACTS OF CLEAN ENERGY DEVELOPMENT

As depicted in **Figure 2-1** and **Table 2-1**, investment in clean energy development increased substantially over the 7-year analysis period. For example, renewable energy project investment in 2013 was $732.4 million, which was about 42 times the size of 2007's $17.5 million. In 2013 alone, clean energy investment was 33% of the total investment from 2007 to 2013.

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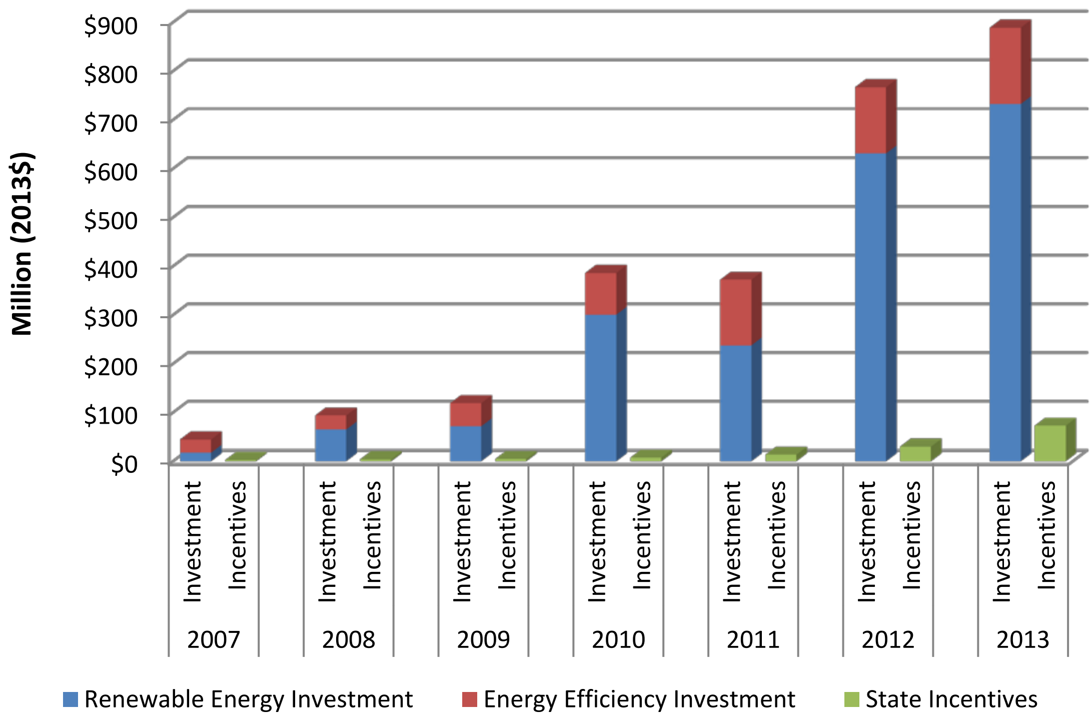
[4] All dollar values are presented in real 2013 terms. Nominal values were adjusted using the U.S. city average annual consumer price index on all items, developed by the Bureau of Labor Statistics.

Figure 2-1. Clean Energy Investment in North Carolina, 2007–2013



See Appendix A for data sources.

Table 2-1. Clean Energy Investment in North Carolina, 2007–2013

Year	Renewable Energy (Million, 2013$)	Renewable Energy % of Total	Energy Efficiency (Million, 2013$)	Energy Efficiency % of Total	Clean Energy Investment (Million, 2013$)	Clean Energy Investment % of Total	State Incentives (Million, 2013$)
2007	$17.5	1%	$27.2	4%	$44.6	2%	$2.3
2008	$65.0	3%	$28.8	5%	$93.8	4%	$4.1
2009	$71.7	3%	$47.4	8%	$119.2	4%	$4.7
2010	$300.6	15%	$85.6	14%	$386.2	14%	$7.4
2011	$237.6	12%	$134.8	22%	$372.4	14%	$13.5
2012	$631.2	31%	$136.0	22%	$767.2	29%	$30.1
2013	$732.4	36%	$156.7	25%	$889.1	33%	$73.1
Total	$2,056.0	100%	$616.5	100%	$2,672.5	100%	$135.2

See Appendix A for data sources. Sums may not add to totals because of independent rounding.

In addition to demonstrating growth in investment value over time, Figure 2-1 and Table 2-1 illustrate that clean energy projects were nearly 20 times as large as the state incentives for them. 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.

The remainder of Section 2.1 reviews in depth

- investment value of clean energy projects,
- energy generated or saved by clean energy projects, and
- state incentives for clean energy development.

2.1.1 Investment Value of Clean Energy Projects

Renewable energy investment was estimated primarily from facilities registered with NC-RETS, supplemented with data from EIA databases—EIA-860 and EIA-923; North Carolina's Department of Environment and Natural Resources; NCUC dockets for individual projects; NC Green Power; and personal communication with industry experts to adjust reported data or address areas where information was incomplete. Investments in energy efficiency were taken from program reports submitted by utilities to the NCUC and annual reports of the Utility Savings Initiative. See **Appendix A** for more information.

Table 2-2 summarizes the cumulative direct spending in renewable energy by category between 2007 and 2013. Investment in renewable energy projects totaled $2,056.0 million. Investment in energy efficiency totaled $616.5 million. Thus, total clean energy investment was $2,672.5 million during the study period.

Of the $2,056.0 million investment in renewable energy projects,

- solar photovoltaics made up $1,619.7 million (79%),
- biomass made up $122.7 million (6%), and
- landfill gas made up $144.6 million (7%).

Table 2-2. Direct Spending in Clean Energy Development by Technology, 2007–2013

Category	Technology	Value (Million, 2013$)	%
Renewable energy direct investment	Biogas fuel cell	$74.8	4%
	Biomass	$122.7	6%
	Geothermal	$24.2	1%
	Hydroelectric (<10MW capacity)[5]	$26.0	1%
	Landfill gas	$144.6	7%
	Passive solar	$3.2	0%
	Solar photovoltaic	$1,619.7	79%
	Solar thermal	$40.2	2%
	Wind	$0.7	0%
	Total	$2,056.0	100%
Energy efficiency direct investment	Utility energy efficiency and demand-side management programs	$428.0	69%
	Utility Savings Initiative	$188.5	31%
	Total	$616.5	100%
Total		$2,672.5	

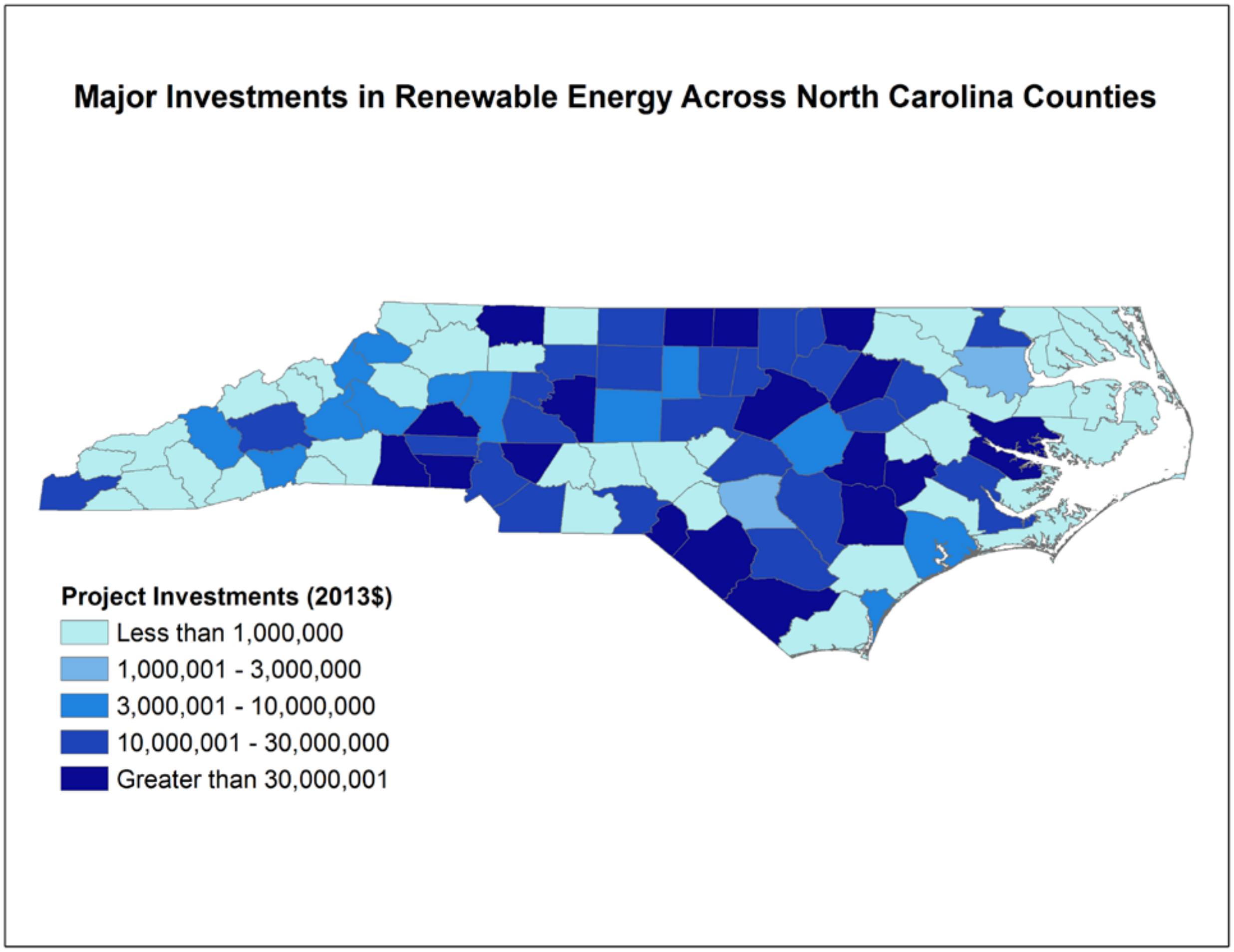
See also Appendix A. Sums may not add to totals because of independent rounding.

Renewable energy projects are widely distributed across North Carolina, bringing investment to both urban and rural counties. **Figure 2-2** illustrates the geographic distribution of renewable energy projects individually valued at $1 million or greater. Including all eligible wind, landfill gas, biomass, hydroelectric, solar photovoltaics, and solar thermal projects valued over $1 million accounts for renewable project investment of approximately $1,816.4 million (88% of the total $2,056.0 million in renewable investment over the period).

Catawba, Davidson, Duplin, Person, and Robeson Counties each experienced more than $100 million in renewable energy project investment from 2007 through 2013, and Beaufort, Cabarrus, Columbus, Cleveland, Wake, and Wayne Counties each experienced between $50 million and $100 million in renewable project investment.

[5] Hydroelectric projects were found using NC-RETS. RTI worked in collaboration with La Capra Associates, Inc. to verify capacity added within the study period. Only projects under 10 MW are tracked in NC-RETS, so these results may be an underestimate of hydroelectric capacity and investment.

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



See also Appendix B.

In preparing last year's *Economic, Utility Portfolio, and Rate Impact of Clean Energy Development in North Carolina Final Report*, RTI interviewed contacts from clean energy businesses who noted that jobs were often created in rural counties that had been hard hit by contraction in the construction industry.

2.1.2 Energy Generated or Saved from Clean Energy Projects

Tables 2-3 and **2-4** summarize the energy generated by renewable projects and the energy saved by energy efficiency projects between 2007 and 2013.

Table 2-3. Renewable Energy Generation, 2007–2013

Technology	Facilities		Energy-Equivalent Generated	
	Number	%	Thousand MWh	%
Biogas fuel cell	1	0%	27	0%
Biomass (including combined heat and power)	15	1%	4,920	72%
Geothermal	778	40%	48	1%
Hydroelectric (<10 MW capacity)	3	0%	130	2%
Landfill gas	17	1%	973	14%
Passive solar	N/A	N/A	3	0%
Solar photovoltaic	1,045	54%	695	10%
Solar thermal	83	4%	40	1%
Wind	9	0%	2	0%
Total	1,951	100%	6,839	100%

See also Appendix A. Sums may not add to totals because of independent rounding.

Table 2-4. Energy Efficiency Energy Savings, 2007–2013

Program	Energy Saved (Thousand MWh)	Energy Costs Saved (Million, 2013$)
Utility Programs	3,836	$230.1[a]
Utility Savings Initiative	NA[b]	$559.7
Total	3,836	$789.8

[a] Energy savings were estimated using estimate of $0.06/kWh.[6] [b] Data on the energy savings from the Utility Savings Initiative were not provided. We were unable to calculate the energy savings from standard EIA estimates because of uncertainties regarding the costs of energy for Utility Savings Initiative projects.

Renewable energy facilities generated 6.8 million MWh of energy, of which

- 72% was biomass,
- 14% was landfill gas, and
- 10% was solar photovoltaics.

Efficiency initiatives also produced large savings in North Carolina. Energy efficiency programs run by utility companies saved 3.836 million MWh of energy during the study period. The Utility Savings Initiative, a government-run energy

[6] 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.

efficiency program, lacked data on specific MWh saved, but the program documents note savings of $559.7 million on energy expenses. [7]

Thus, total energy generated or saved from clean energy projects is estimated to amount to at least 10.7 million MWh.

2.1.3 State Incentives for Clean Energy Investment

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

Investment spending was funded, in part, through state incentives. Through direct state government appropriation, renewable energy projects received $122.6 million in tax credits and energy efficiency projects received $12.6 million. Total government expenditures were $135.2 million between 2007 and 2013 (**Table 2-5**).

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 $2,672.5 million.

However, the $135.2 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 gross impacts slightly. Section 2.3 includes discussion that illustrates these offsets.

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[7] The cost of energy avoided from the Utility Savings Initiative was calculated using data from the "Annual Report for the Utility Savings Initiative for Fiscal Year July 1, 2012–June 30, 2013." First, sums of avoided energy costs per calendar year were calculated from the fiscal year sums, assuming that energy savings were equally split between the calendar years in each fiscal year. Without full data for 2013, RTI assumed energy costs were avoided at the same rate in the second half of 2013 as they were during the fiscal year from 2012 to 2013. To convert sums to 2013 U.S. dollars, we applied inflation multipliers calculated from the CPI-U (see Table A-3).

Table 2-5. State Incentives for Clean Energy Development, 2007–2013

Year	Renewable Energy Tax Credit[a,b] (Million, 2013$)	Energy Efficiency[c] (Utility Savings Initiative, Million, 2013$)	Total (Million, 2013$)
2007	$0.5	$1.8	$2.3
2008	$2.3	$1.8	$4.1
2009	$2.9	$1.8	$4.7
2010	$5.6	$1.8	$7.4
2011	$11.7	$1.8	$13.5
2012	$28.3	$1.8	$30.1
2013	$71.3	$1.8	$73.1
Total	$122.6	$12.6	$135.2

Note: For the Utility Savings Initiative, an appropriation of $12.6 million was taken, which we distributed evenly across the study period for the purposes of the analysis. Tax credit for 2013 estimated; this estimation is detailed in Appendix A.

[a]North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2007-2011). Unaudited NC-478G. Raleigh, NC: North Carolina Department of Revenue, Policy Analysis and Statistics Division.

[b]North Carolina Department of Revenue, Revenue Research Division. (2012). "Credit for Investing in Renewable Energy Property Processed during Calendar Year 2012." Raleigh, NC: North Carolina Department of Revenue, Revenue Research Division.

[c]North Carolina Department of Commerce. (November 1, 2013). "Annual Report for the Utility Savings Initiative for Fiscal Year July 1, 2012–June 30, 2013." Raleigh, NC: North Carolina Department of Commerce.

2.2 SECONDARY IMPACTS OF CLEAN ENERGY DEVELOPMENT

To estimate the overall impact of clean energy development in North Carolina, the spending described in Section 2.1 was analyzed using 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.

I-O models provide a detailed snapshot of the purchasing relationships between sectors in the regional economy. In response to these direct inputs, the 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.

Increased renewable energy production requires increased employment in that sector and in the sectors in its supply chain (indirect impacts). 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 renewable energy production and the decreased consumer spending resulting from decreased direct and indirect employment associated with conventional energy production.

The total economic impact of clean energy for North Carolina is the sum of the direct, indirect, and induced impacts. **Figures 2-3** and **2-4** describe direct, indirect, and induced impacts.

Figure 2-3. Renewable Energy Direct, Indirect, and Induced Economic Impacts Related to Clean Energy Incentives

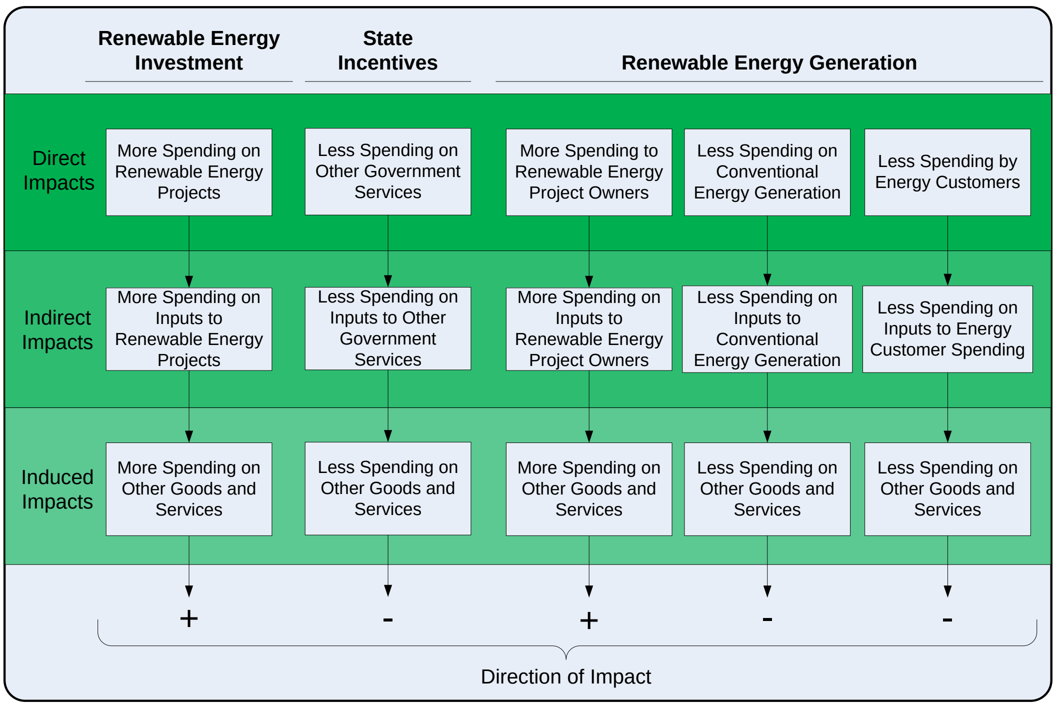
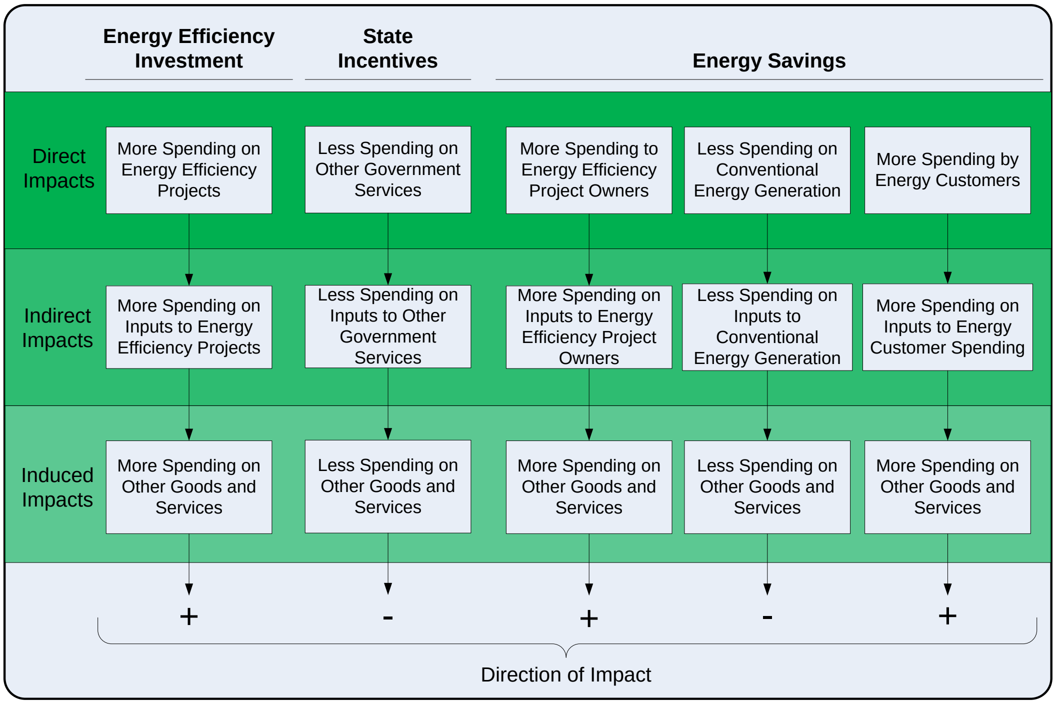


Figure 2-4. Energy Efficiency Direct, Indirect, and Induced Economic Impacts Related to Clean Energy Incentives



Two types of secondary economic impacts were modeled in this study:

- those resulting from the value of investment dollars spent on a clean energy project representing indirect and induced supply chain effects and
- those resulting from the reduction in spending on the production of conventional energy and that are reallocated to energy efficiency and renewable project owners.

The second bullet in particular requires further explanation because the spending changes associated with renewable energy generation and energy efficiency may not be readily apparent.

2.2.1 Changes in North Carolina Spending Patterns from Renewable Energy Generation

To estimate the changes in spending resulting from renewable energy *generation*, renewable energy produced by facilities was estimated by applying capacity factors, either at the facility level based on 2011 generation (EIA-923) or the technology level (see Table 2-1). Electricity generated by these facilities is assumed to receive $0.06/kWh[8] in avoided costs, which was modeled as a transfer to renewable generation from inputs to conventional generation. Renewable thermal energy produced by these facilities was modeled as a transfer of the retail electricity rate between utilities and utility customers ($0.0682/kWh for industrial and $0.099/kWh for commercial and residential customers [EIA, 2013]). Finally, the full Renewable Energy Portfolio Standard (REPS) rider over these years was modeled as a transfer from utility customers to renewable project owners.

As Table 2-3 stated, renewable energy facilities have generated an estimated 6.839 million MWh of energy over the study period. This generation is estimated to have resulted in a total of $429.6 million[9] in avoided cost and retail energy savings no longer spent on conventional energy. The total REPS rider over the study period is estimated to be $213.0 million.[10]

2.2.2 Changes in North Carolina Spending Patterns from Energy Efficiency Initiatives

To estimate changes in spending resulting from *energy savings* from energy efficiency, the avoided cost of energy saved by utility energy efficiency and demand-side management programs was modeled as 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.[11] Energy savings from the Utility Savings Initiative were a

[8] 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.

[9] This $429.6 million was calculated by multiplying 4,796,694 MWh generated by nonthermal renewable projects by $60/MWh avoided cost to yield $287,801,617. The 1,951,282 industrial thermal MWh generated was multiplied by industrial retail savings of $68.20/MWh (EIA, 2012) to yield $133,077,411. Lastly, the 88,022 commercial and residential thermal MWh generated was multiplied by the average retail savings of $99/MWh (EIA, 2012) to yield $8,714,148. Summing the three totals together yields $429,593,176.

[10] This total was estimated using the most recent REPS cost data available at the time of the analysis. Documents issued after this analysis was performed include some minor adjustments, as well as providing costs for a new utility, Dominion North Carolina Power.

[11] Duke Energy's Save-A-Watt program was chosen as a model for simulating the transfer of avoided energy costs for both its size and the simplicity of its avoided cost allocation method.

transfer from utilities to government spending. A full description of how these assumptions were implemented is provided in Appendix A.

As Table 2-4 indicated, utility programs yielded 3.836 million MWh in energy savings. The avoided cost for these programs, assuming $0.06/kWh stated previously, was $230.1 million.[12] Combining this with the $559.7 million saved by the Utility Savings Initiative, total energy efficiency savings was $789.8 million.

2.3 NORTH CAROLINA ECONOMY-WIDE IMPACTS

In summary, total output (gross revenue) in North Carolina associated with clean energy development, after accounting for secondary effects, is estimated at $4,710.8 million over the 7-year period from 2007 to 2013. Clean energy development accounted for $2,971.5 million in GSP over the study period. Total employment effects were estimated to be 37,100 FTEs over the study period.

2.3.1 Impacts Associated with Renewable Energy Projects

As shown in the first data row of **Table 2-6**, $2,056.0 million in in-state spending on renewable energy projects has a direct impact on GSP ($1,218.2 million), employment (13,775 FTEs), and state and local tax revenue ($160.9 million).

These renewable projects received an estimated $122.6 million of state tax credits between 2007 and 2013. Because in the absence of the incentive program the state government would have spent the money on something else, there is an offsetting direct economic impact that must be considered.

Out of $122.6 million, the state government would have spent $99.3 million in state and spent $23.3 million out of state for goods and services, according to IMPLAN's assumptions. Therefore, the direct economic impact from the change in government spending patterns is −$99.3 million. GSP, employment, and fiscal impacts are reduced as well. Note that the second data row of Table 2-6 shows an offsetting direct economic impact using negative values.

[12] The avoided cost was calculated by multiplying 3,835,695 MWh by $60/MWh ($0.06/kWh) avoided cost to yield $230,141,700.

Table 2-6. Renewable Energy Projects Economic Impacts, 2007–2013

	Total Output[a] (Million, $2013)	Gross State Product[b] (Million, $2013)	Employment (Full-Time Employee Equivalents)	Fiscal Impacts (Million, $2013)
Direct economic impact from renewable energy	$2,056.0	$1,218.2	13,775	$160.9
Direct economic impact from change in government spending[c]	−$99.3	−$85.3	−1,336	−$3.2
Secondary economic impact	$1,698.8	$1,067.2	11,091	$78.7
Total economic impact	$3,655.5	$2,200.1	23,531	$236.3

[a] Total output refers to revenue received by North Carolina individuals and businesses. [b] Gross state product represents the total value added. [c] Direct economic impact from change in government spending refers to the in-state impact of $122.6 million in renewable tax credits, less $23.3 million that would have otherwise procured goods and services from out of state. Note: Sums may not add to totals because of rounding. See also Appendix A.

The two direct impacts—the increase in renewable energy project spending and the reduction in state government spending on other things—are combined and analyzed to estimate the changes in spending resulting from renewable energy generation and the indirect and induced impacts resulting from supply chain effects and changes in income.

Ultimately, the total economic impact amounts to a contribution to GSP of $2,200.1 million, 23,531 FTEs, and $236.3 million in state and local tax revenue.[13]

2.3.2 Impacts Associated with Major Energy Efficiency Initiatives

Table 2-7 provides the same impact information as Table 2-6 for the energy efficiency initiatives. It was estimated that there was $616.5 million in energy efficiency investment, and the resulting energy savings and changes in spending over the study period contributed $771.4 million to total GSP and supported 13,570 FTEs.

[13] Although not broken out in Table 2-6, the substitution of renewable energy for conventional energy, including reduced household spending due to the REPS rider, resulted in a small positive impact to employment, economic output, and state and local tax revenue.

Table 2-7. Energy Efficiency Initiatives Economic Impacts, 2007–2013

	Total Output[a] (Million, 2013$)	Gross State Product[b] (Million, 2013$)	Employment (Full-Time Employee Equivalents)	Fiscal Impacts (Million, 2013$)
Direct economic impact from energy efficiency	$616.5	$360.9	4,648	$19.1
Direct economic impact from change in government spending[c]	−$10.2	−$8.8	−137	−$0.3
Secondary economic impact	$449.0	$419.3	9,059	−$23.1
Total economic impact	$1,055.3	$771.4	13,570	−$4.3

[a] Total output refers to revenue received by North Carolina individuals and businesses. [b] Gross state product represents the total value added. [c] Direct economic impact from change in government spending refers to the in-state impact of $12.6 million in state government procurement to the Utility Savings Initiative, less $2.4 million that would have otherwise procured goods and services from out of state. Note: Sums may not add to totals because of rounding. See also Appendix A.

As with state incentives for renewable energy projects, there is an offsetting negative direct impact associated with government spending on the Utility Savings Initiative and not on other activities. If the state government were to spend $12.6 million on other government services, $2.4 million would have been spent out-of-state. See the second data row of Table 2-7.

A net negative fiscal impact of $4.3 million was estimated for energy efficiency projects due primarily to negative fiscal impacts from their resulting energy savings. This is primarily because more state and local taxes are estimated to be recovered from a dollar of spending on utilities than on other government services now purchased from Utility Savings Initiative savings.

2.3.3 Total Impact Associated with Clean Energy Projects

For 2007 through 2013 the total economic activity associated with renewable energy projects and energy efficiency initiatives was (**Table 2-8**):

- $4,710.8 million in gross output (revenue),
- $2,971.5 million in GSP (value-added),
- 37,100 FTEs, and
- $232.0 million in state and local tax revenues.

Table 2-8. Total Economic Impacts, 2007–2013

	Total Output[a] (Million, 2013$)	Gross State Product[b] (Million, 2013$)	Employment (Full-Time Employee Equivalents)	Fiscal Impacts (Million, 2013$)
Direct economic impact	$2,672.5	$1,579.0	18,423	$180.0
Direct economic impact from change in government spending[c]	−$109.5	−$94.0	−1,473	−$3.6
Secondary economic impact	$2,147.7	$1,486.5	20,150	$55.6
Total economic impact	$4,710.8	$2,971.5	37,100	$232.0

[a] Total output refers to revenue received by North Carolina individuals and businesses. [b] Gross state product represents the total value added. [c] Direct economic impact from change in government spending refers to the in-state impact of $135.2 million in State clean energy incentives, less $25.7 million that would have otherwise procured goods and services from out of state. Note: Sums may not add to totals because of rounding. See also Appendix A.

These results account for a comparatively small offset associated with government spending changes because the tax credit and appropriations for the Utility Savings Initiative caused an estimated loss in output of $109.5 million. 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.

In Table 2-8, the fiscal impact analysis shows that state and local governments realized revenue of $232.0 million as a result of gross changes in economic activity.

References

Lawrence, S., Loomis, R., Stevens R., Heller K., Pereira, A., Gilbert C., et al. (2013). *The Economic, Utility Portfolio, and Rate Impact of Clean Energy Development in North Carolina – Final Report*. Prepared for the North Carolina Sustainable Energy Association. Research Triangle Park, NC: RTI International. http://energync.org/assets/files/RTI%20Study%202013.pdf.

North Carolina Department of Commerce. (November 1, 2013). "Annual Report for the Utility Savings Initiative for Fiscal Year July 1, 2012–June 30, 2013." Raleigh, NC: North Carolina Department of Commerce.

North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2007–2011). Unaudited NC-478G. Raleigh, NC: North Carolina Department of Revenue, Policy Analysis and Statistics Division.

North Carolina Department of Revenue, Revenue Research Division. (2012). "Credit for Investing in Renewable Energy Property Processed during Calendar Year 2012." North Carolina Department of Revenue, Revenue Research Division.

U.S. 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.

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

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

U.S. Energy Information Administration (EIA). (2014). Electric Power Annual Data. http://www.eia.gov/electricity/annual/?src=Electricity-f4.

Appendix A:
Technical Appendix

A.1 RENEWABLE TECHNOLOGY DATA SOURCES AND ASSUMPTIONS

A.1.1 Solar Photovoltaic

Installed solar photovoltaic capacity between 2007 and 2013 was estimated based on data from North Carolina Renewable Energy Tracking System (NC-RETS, 2014), NC GreenPower (North Carolina GreenPower, personal communication, February 20, 2014), 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 on RTI's review of 2011 photovoltaic generation in North Carolina (U.S. Energy Information Administration [EIA], 2011) and PVWattv2 (National Renewable Energy Laboratory [NREL], 2012b).

Because of the magnitude of solar photovoltaic relative to other clean energy projects and the rapid decline in the cost of photovoltaic installations over the time period (NREL, 2012a), we developed cost estimates for installations by size of system and year of installation. These estimates rely on data reporting photovoltaic project costs through December 31, 2013 that the North Carolina Sustainable Energy Association (NCSEA) compiled from NCUC.[14] 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. As a data quality check, RTI independently reviewed several registrations to verify values within the database against North Carolina Utilities Commission (NCUC) dockets. RTI 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 2013$ using the consumer price index (CPI) (Bureau of Labor Statistics [BLS], 2013). Table A-1 shows RTI's estimates of the average costs per kW (AC), which are consistent with other available photovoltaic cost data sources over the study period. It is worth noting that data for the 10 kW to 100 kW category were unavailable for 2013, so

[14] It is worth noting that these data were not used to expand our list of PV projects, because of an absence of project-identifying data.

we assumed the 2012 value. Annual fixed operating and maintenance (O&M) costs were assumed to be $26/kW.[15]

Table A-1. Average Cost for Solar photovoltaic Installations by Year and Size (AC kW, 2013$)

Expected Year Online	<10 kW	10 kW–100 kW	100 kW–1 MW	1 MW–2 MW	>2 MW
2006	18,247				
2007	13,495	11,552			
2008	12,374	11,547	13,011		
2009	11,096	10,215	7,619		
2010	9,369	8,166	6,787	5,720	
2011	8,292	7,006	6,164	5,834	3,915
2012	7,821	6,403	5,247	4,770	4,133
2013	6,306	6,311	3,291	3,848	3,985

A.1.2 Landfill Gas

Capacity for landfill gas (LFG) facilities was estimated using data from NC-RETS (2014) and modified based on personal communication for one facility. We estimated generation by LFG facilities based on EIA 2011 and 2012 generation data (EIA, 2011; EIA, 2012) where available and otherwise applied a uniform capacity factor. Installation and O&M costs were also based on uniform estimates with the exception of personal communication regarding installation costs for one facility.

In addition to standard LFG facilities, the NC-RETS (2014) database indicated the addition of an LFG fuel cell project in 2012. Project capacity was provided by NC-RETS but was modified based on EIA generation data (EIA, 2012). Installation costs were assumed to be $7,000 per kW of rated output, with variable operation and maintenance (O&M) costs of $43 per MWh (EIA, 2013a; EIA, 2013c).

A.1.3 Hydroelectric

NC-RETS (2014) represents the universe from which we pulled specific hydroelectric projects. Because NC-RETS tracks only hydroelectric projects under 10 MW, our analysis may

[15] Installment costs, O&M costs, capacity factor, and fuel cost assumptions for all renewable technologies included in our analysis are reported in Table 4-1 of the Economic, Utility Portfolio, and Rate Impact of Clean Energy in Development in North Carolina, available at http://energync.org/assets/files/RTI%20Study%202013.pdf.

underestimate total hydroelectric investment over the study period. RTI estimated new or incremental capacity at hydroelectric facilities between 2007 and 2013 from NC-RETS, EIA data (EIA, 2011), and NCUC registrations (Duke Energy, 2012; Kleinschmidt, N/A; Brooks Energy, 2008; Advantage Investment Group LLC, 2004; Cliffside Mills LLC, 2008; Madison Hydro Partners, 2010).

A.1.4 Biomass

Capacity for biomass facilities installed between 2007 and 2013 was estimated using data from NC-RETS (2014) 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. Installation, O&M, and fuel costs were based on uniform estimates 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 was developed from NC-RETS (2014) and NCUC registrations for eight facilities (EPCOR USA, 2009). Capacity for co-fired facilities was adjusted to reflect the 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 generation data (EIA, 2011) where available and otherwise applied a uniform capacity factor. 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 (2014) and NC GreenPower (personal communication, February 20, 2014). Capacity factor and installation and O&M costs were based on uniform estimates 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 2013 are based on data reported in NC-RETS (2014). 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 $3,500/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 assumed that solar thermal heating systems have the same capacity factor as photovoltaic 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, February 14, 2014). Although 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 five 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 assumed the cost of an average 3 ton system to be $20,000. Because of a 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 (International Energy Agency [IEA], 2010).

A.1.9 Passive Solar

Passive solar tax credit spending data from the NC Department of Revenue (2007–2012) are the only available data for passive solar projects over the study period. Energy savings were estimated based on the number of passive solar projects from NC Department of Revenue data, as well as information on typical kWh savings provided by the Oregon Department of Energy (2012) and a study by RETScreen International (2004).

A.1.10 State Incentives for Renewable Energy

Tax credits taken for 2007 through 2012 were developed from figures provided by the NC Department of Revenue (2011b; 2012a). We estimated the 2013 tax credits taken assuming that all renewable investment estimated in 2013 would generate tax credits at the same ratio of tax credits generated to the value of renewable property claimed in 2012 (34%) and that 20% of all credits generated between 2009 and 2013 would be taken in 2013.

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 assumed 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 Energy Carolinas (2012b) and Progress (2012a), we applied the simplifying assumption that the avoided cost paid to all renewable facilities is $60/MWh.

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

The total Renewable Energy Portfolio Standard (REPS) rider charged to customers over the study period was taken from NCUC dockets (Duke Energy Carolinas, 2009b, 2010, 2011, 2012a, 2012b, Progress, 2009b, 2010a, 2011b, 2012a, 2013a, GreenCo, 2010a, 2010c, 2012a, 2012b, 2013; ElectriCities, 2009, 2010, 2011a, 2012a, 2013a) and included in the analysis as a change in spending to project owners from utility customers.

A.1.12 Universe of Included Projects

Table A-2 summarizes the sources used to compile our list of renewable energy and energy efficiency projects. Although additional resources were used to characterize these projects, the universe of projects in this analysis was limited to the sources below.

A.1.13 Inflation Adjustments

To accurately compare expenditures over time, it was necessary to convert all dollars to the same year. Table A-3 presents the CPI data from the BLS that we used to adjust for inflation.

Table A-2. Sources Used in Compiling the Universe of Included Projects

	NC-RETS	NC Green-Power	Press Releases	Personal Communi-cation	NCDENR	NC DOR	NCUC Dockets
Solar photovoltaic	x	x	x	x			
Landfill gas	x						
Hydroelectric	x						
Biomass	x						
Wind	x	x					
Solar thermal Heating	x						
Geothermal heat pumps					x		
Passive solar						x	
Utility energy efficiency							x

Table A-3. Inflation Adjustment Factors

Year	Consumer Price Index for All Urban Consumers	Multiplier for Conversion to 2013 USD
2006	201.60	1.16
2007	207.34	1.12
2008	215.30	1.08
2009	214.54	1.09
2010	218.06	1.07
2011	224.94	1.04
2012	229.59	1.01
2013	232.96	1.00

Source: BLS, 2013.

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 2013 (Dominion North Carolina Power, 2010, 2011, 2012, 2013), Duke Energy Carolinas (2013a), NC GreenCo (2010b), NCMPA1 and NCEMPA (ElectriCities, 2011b; 2011c; 2011d; 2011e; 2011f; 2011g; 2012b; 2012c; 2013b; 2013c), and Progress (Progress, 2008, 2009a, 2010b, 2011a, 2012b, 2013b). Demand-side management program costs were only included for 2011 through 2013 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 were estimated based on NC-RETS data (2014). Energy savings from utility programs in 2013 were estimated from expected 2013 savings from NCUC dockets (Duke Energy Carolinas, 2013b; Progress, 2012c; GreenCo, 2012b). 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 Carolinas, 2009a).

A list of the utility programs considered in our analysis is included in Table A-4.

Table A-4. Utility Energy Efficiency Programs

Program	Utility
Commercial Distributed Generation Program	Dominion
Commercial Energy Audit	Dominion
Commercial Duct Testing & Sealing	Dominion
Commercial HVAC Upgrade Program	Dominion
Commercial Lighting Program	Dominion
Low Income Program	Dominion
Residential Air Conditioning Cycling	Dominion
Residential Audit	Dominion
Residential Duct Testing & Sealing	Dominion
Residential Heat Pump Tune-up	Dominion
Residential Heat Pump Upgrade	Dominion

(continued)

Table A-4. Utility Energy Efficiency Programs (continued)

Program	Utility
Residential Lighting Program	Dominion
Appliance Recycling Program	Duke
Energy Efficiency in Schools	Duke
Home Retrofit	Duke
Low Income Weatherization	Duke
Non Residential Smart Saver Lighting	Duke
Non-Residential Energy Assessments	Duke
Non-Residential Smart Saver	Duke
Power Manager	Duke
Power Share	Duke
Residential Energy Assessments	Duke
Residential Energy Comparison Report	Duke
Residential Neighborhood Program	Duke
Residential Smart Saver	Duke
Smart Energy Now	Duke
Agricultural Energy Efficiency	GreenCo
Commercial Energy Efficiency	GreenCo
Commercial New Construction	GreenCo
Community Efficiency Campaign	GreenCo
Energy Cost Monitor	GreenCo
Energy Star Appliances	GreenCo
Energy Star Lighting	GreenCo
Low Income Efficiency Campaign	GreenCo
Refrigerator/Freezer Turn-In	GreenCo
Residential New Home Construction	GreenCo
Water Heating Efficiency	GreenCo
C&I Energy Efficiency Program	NCMPA
Commercial Prescriptive Lighting Program	NCMPA
High Efficiency Heat Pump Rebate	NCMPA
Home Energy Efficiency Kit	NCMPA
LED and ECM Pilot for Refrigeration Cases	NCMPA
Municipal Energy Efficiency Program	NCMPA
Commercial, Industrial, and Government Demand Response	Progress
Commercial, Industrial, and Government Energy Efficiency	Progress
Compact Fluorescent Light Pilot	Progress
Distribution System Demand Response	Progress
EnergyWise	Progress
Lighting—General Service	Progress
Residential Energy Efficiency Benchmarking	Progress

(continued)

Table A-4. Utility Energy Efficiency Programs (continued)

Program	Utility
Residential Appliance Recycling	Progress
Residential Home Advantage	Progress
Residential Home Energy Improvement	Progress
Residential Lighting	Progress
Residential Low Income Program	Progress
Residential New Construction	Progress
Small Business Energy Saver	Progress
Solar Hot Water Heating Pilot	Progress

A.2.1 Utility Savings Initiative

Data on the cost, savings, and incentives for the Utility Savings Initiative were taken from the project's 2013 annual report (NC Department of Commerce, 2013).

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-5).

Table A-5. 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 Photovoltaic 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.

(continued)

Table A-5. IMPLAN Breakout for Renewable Energy, Energy Efficiency, and State Spending (continued)

Type	Direct Spending	Secondary Effects
Renewable Energy (cont.)		
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 costs were 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 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 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 2009 Bipartisan Policy Center report. Fuel costs were allocated to Sector 15, Forestry, Forest Products, and Timber Tract Production.

(continued)

Table A-5. 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-5. 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 the photovoltaic breakout for 100 kW–1 MW systems from JEDI Photovoltaic 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	Utility Savings Initiative program investments were allocated to IMPLAN sectors according to the Commercial Retrofit category in the 2005 Regulatory Assistance Project report.	Utility Savings Initiative 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		Utility Savings Initiative appropriations deducted from IMPLAN State Spending breakout.

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 by 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.

A.4 DIFFERENCES FROM LAST YEAR'S REPORT

The results of this analysis differ from last year's *Economic, Utility Portfolio, and Rate Impact of Clean Energy Development in North Carolina Final Report* (Lawrence, Loomis, Stevens, Heller Pereira, & Gilbert, et al., 2013). The list below outlines several changes to the underlying data, study scope, and reporting conventions that may lead to differences between the reports.

- Dollars are reported in $2013 USD in this report, where they were reported in $2011 USD in last year's report.
- The study frame was expanded to include 2013, whereas the last report's study frame was 2007 to 2012.
- Differences in yearly renewable energy investment can be explained by the availability of new data on the timing of photovoltaic investments from NC GreenPower, the addition of new renewable energy projects in the NC RETS database that were not present at the time of the 2013 report, updated geothermal data from NC DENR, updated data and methods for estimating passive solar investments, and an updated method for allocating biomass investment over the study time frame.
- Differences in yearly energy efficiency investment can be explained by the addition of costs for several more utility energy efficiency programs and the addition of more extensive cost data for utility programs already tracked in the last report. Also, since Utility Savings Initiative spending data are not available annually, lengthening the study frame requires a new allocation of total investment to prior years.
- Differences in yearly state incentives can be explained by several factors. For one, because Utility Savings Initiative state appropriation data are not available

annually, lengthening the study frame requires a new allocation of total appropriation to prior years. Also, whereas the 2013 report estimated 2012 tax credits taken, this study used retrospective data provided by the NC Department of Revenue for this year's tax credits.

- An error in Table 3-2 of the 2013 report indicated that 1,314 thousand MWh were generated by passive solar. However, this should have been reported as 1,314 MWh. This error did not impact IMPLAN results, however. This report estimates that passive solar energy generation totaled 3,000 MWh between 2007 and 2013.

A.5 REFERENCES

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

ASU News. (2009). "Appalachian Installs Wind Turbine on Campus." 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." Washington, DC: Bipartisan Policy Center.

Bosch Group. 2007. "Green Home Raleigh." 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." 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._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. 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. 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._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. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed November 1, 2012.

Dominion North Carolina Power. (2013). “Direct Testimony of David L. Turner Filed 8-20-2013 with Application.” E-22 Sub 494. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

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

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

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

Duke Energy Carolinas, LLC. (2012a). “Duke’s REPS Cost Recovery Rider and 2011 REPS Compliance Report.” E-7 Sub 1008._http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 22, 2013.

Duke Energy Carolinas, LLC. (2012b). “Duke Energy Carolinas, LLC’s 2011 REPS Compliance Report and Application for Cost Recovery.” E-7 Sub 1034. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

Duke Energy Carolinas, LLC. (2013a). “Application for Approval of DSM and EE Cost Recovery Rider-Part 1.” E-7 Sub 1031. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

Duke Energy Carolinas, LLC. (2013b). “Integrated Resource Plan (Annual Report). http://www.duke-energy.com/pdfs/DEC_2013_IRP_10.23.2013.pdf. Accessed February 14, 2014.

Duke Energy. (2012). “Bridgewater Hydroelectric Station.” 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. http://www.duke-energy.com/news/releases/ 2013011001.asp. Accessed February 12, 2013.

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

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

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

ElectriCities. (2011b). “NCEMPA’s Revised 2008 REPS Compliance Report.” E-100 Sub 131. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

ElectriCities. (2011c). “NCEMPA’s Revised 2009 REPS Compliance Report.” E-100 Sub 131. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

ElectriCities. (2011d). “NCEMPA’s 2010 REPS Compliance Report (Redacted).” E-100 Sub 131. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

ElectriCities. (2011e).”NCMPA1’s Revised 2008 REPS Compliance Report (Redacted).” E-100 Sub 131. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

ElectriCities. (2011f). “NCMPA1’s Revised 2009 REPS Compliance Report.” E-100 Sub 131. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

ElectriCities. (2011g). “NCMPA1’s 2010 REPS Compliance Report.” E-100 Sub 131. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

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

ElectriCities. (2012b). “NCEMPA’s 2011 REPS Compliance Report—Public Version.” E-100 Sub 135. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

ElectriCities. (2012c). “NCMPA1’s 2011 REPS Compliance Report—Public Version.” E-100 Sub 135. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

ElectriCities. (2013a). “2013 REPS Compliance Plans & 2012 REPS Compliance Reports.” E-100 Sub 139. http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed February 14, 2014.

ElectriCities. (2013b). “NCEMPA’s REPS Compliance Report for 2012.” E-100 Sub 139. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

ElectriCities. (2013c). “NCMPA1’s 2011 REPS Compliance Report for 2012.” E-100 Sub 139. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

EPCOR USA North Carolina, LLC. (2009). "Order Issuing Amended Certificates, Accepting Registration Statement, and Issuing Declaratory Ruling." Docket SP-165 Sub 3. 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." 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. http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed November 1, 2012.

GreenCo. (2010b). "Amended Energy Efficiency Approval Requests." EC-83 Sub 0. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

GreenCo. (2010c). "Investigation of Integrated Resource Planning in NC-2010." E-100 Sub 128. 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. 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. http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed February 14, 2014.

GreenCo. (2013). "2013 REPS Compliance Plans & 2012 REPS Compliance Reports." E-100 Sub 139. http://www.ncuc.commerce.state.nc.us/docket.htm. Accessed February 14, 2014.

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

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

Lawrence, S., Loomis, R., Stevens R., Heller K., Pereira, A., Gilbert C., et al. (2013). *The Economic, Utility Portfolio, and Rate Impact of Clean Energy Development in North Carolina – Final Report*. Prepared for the North Carolina Sustainable Energy Association. Research Triangle Park, NC: RTI International. http://energync.org/assets/files/RTI%20Study%202013.pdf.

Madison County School System. (2009). “Report of Proposed Construction & Registration Statement for 2.4 kW Grid Tied Turbine.” SP-432 Sub 1. 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. 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 (NREL). (2011a). “Break-Even Cost for Residential Solar Water Heating in the United States: Key Drivers and Sensitivities.” http://www.nrel.gov/docs/fy11osti/48986.pdf. Accessed January 15, 2013.

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

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

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

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

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

News and Observer. (2012). "Company Building Gigantic Solar Water Heating System at Turkey Plant." 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. http://www.thrivenc.com/newsandevents/recovery-act-funds-support-innovative-nc-energy-projects. Accessed January 15, 2013.

North Carolina Department of Commerce. (2013). "2013 Utility Savings Initiative (USI) Annual Report." November 1, 2013. Raleigh, NC: North Carolina Department of Commerce.

North Carolina Department of Environment and Natural Resources (NCDENR). (February 14, 2014). Personal communication with Thomas Slusser.

North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2007). "Energy Tax Credit Generated, Process Year 2007." Unpublished. Raleigh, NC: North Carolina Department of Revenue, Policy Analysis and Statistics Division.

North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2008). "Energy Tax Credit Generated, Process Year 2008." Unpublished. Raleigh, NC: North Carolina Department of Revenue, Policy Analysis and Statistics Division.

North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2009). "Energy Tax Credit Generated, Process Year 2009." Unpublished. Raleigh, NC: North Carolina Department of Revenue, Policy Analysis and Statistics Division.

North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2010). "Energy Tax Credit Generated, Process Year 2010." Unpublished. Raleigh, NC: North Carolina Department of Revenue, Policy Analysis and Statistics Division.

North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2011a). “Energy Tax Credit Generated, Process Year 2011.” Unpublished. Raleigh, NC: North Carolina Department of Revenue, Policy Analysis and Statistics Division.

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

North Carolina Department of Revenue, Revenue Research Division. (2012a). “Credit for Investing in Renewable Energy Property Processed during Calendar Year 2012.” Raleigh, NC: North Carolina Department of Revenue, Revenue Research Division.

North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2012b). “Energy Tax Credit Generated, Process Year 2012.” Unpublished. Raleigh, NC: North Carolina Department of Revenue, Policy Analysis and Statistics Division.

North Carolina Renewable Energy Tracking System (NC-RETS). Available at http://www.ncrets.org/. Accessed February 18, 2014.

North Carolina GreenPower. (February 20, 2014). Personal communication with Katie Shepherd.

Oregon Department of Energy. (2012). “Basic Solar Information.” 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. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed January 15, 2013.

Progress Energy Carolinas, Inc. (2008). “Application for Approval of DSM & Energy Efficiency Cost Recovery & Testimony & Exhibits of Evans.” E-2 Sub 931. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

Progress Energy Carolinas, Inc. (2009a). “Application for Approval of DSM & Energy Efficiency Cost Recovery Rider.” E-2 Sub 951. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

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

Progress Energy Carolinas, Inc. (2011a). "Application for Approval of DSM and Energy Efficiency Cost Recovery and Direct Testimony." E-2 Sub 1002. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

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

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

Progress Energy Carolinas, Inc. (2012b). "Application for Approval of DSM and Energy Efficiency Cost Recovery Rider." E-2 Sub 1019. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

Progress Energy Carolinas, Inc. (2012c). "Progress Energy Carolinas Integrated Resource Plan." http://www.energy.sc.gov/files/view/ProgressEnergyResource%20Plan2012.pdf. Accessed February 14, 2014.

Progress Energy Carolinas, Inc. (2013a). "Application for Approval of Renewable Energy Efficiency Portfolio Standard (REPS) Cost Recovery Rider." E-2 Sub 1032. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

Progress Energy Carolinas, Inc. (2013b). “Duke Energy Progress’ Exhibits and Workpapers of Robert P. Evans Filed with Application.” E-2 Sub 1030. http://www.ncuc.commerce.state.nc.us /docket.htm. Accessed February 14, 2014.

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

RETScreen International. (2004). “Passive Solar Heating Project Analysis.” http://www.retscreen.net/ang/passive_solar_heating_e_textbook_chapter.php. Accessed February 17, 2014.

U.S. Bureau of Labor Statistics. (2013). “Consumer Price Index All Urban Consumers.” http://www.bls.gov/cpi/#data. Accessed February 11, 2014.

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

U.S. Energy Information Administration (EIA). (2012). Form EIA-923 Annual Electric Utility Database. http://www.eia.gov/electricity/data/eia923/index.html. Accessed February 15, 2014.

U.S. Energy information Administration (EIA). (2013a). “Assumptions to the Annual Energy Outlook 2013.” http://www.eia.gov/forecasts/aeo/assumptions/pdf/electricity.pdf.

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

U.S. Energy Information Administration (EIA). (2013c). “Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants.” http://www.eia.gov/forecasts/capitalcost/pdf/updated_capcost.pdf.

Appendix B: Renewable Energy Projects Valued at $1 Million or Greater by County

Table B-1. Major Investments in Renewable Energy Across North Carolina Counties

County Name	Solar	Landfill Gas	Hydro	Biomass	Solar Thermal	Total
Alamance	3,421,086	—	—	—	—	3,421,086
Alexander	6,584,279	—	—	—	—	6,584,279
Alleghany	—	—	—	—	—	—
Anson	—	—	—	—	—	—
Ashe	—	—	—	—	—	—
Avery	4,931,295	—	—	—	—	4,931,295
Beaufort	51,667,033	—	—	—	—	51,667,033
Bertie	—	—	—	1,696,437	—	1,696,437
Bladen	19,825,375	—	—	—	—	19,825,375
Brunswick	—	—	—	—	—	—
Buncombe	18,045,187	3,703,653	—	—	—	21,748,840
Burke	1,232,824	—	4,585,831	—	—	5,818,654
Cabarrus	23,319,011	29,838,615	—	—	1,446,279	54,603,904
Caldwell	—	—	—	—	—	—
Camden	—	—	—	—	—	—
Carteret	—	—	—	—	—	—
Caswell	39,650,750	—	—	—	—	39,650,750
Catawba	128,947,258	74,783,496	—	—	—	203,730,754
Chatham	4,770,220	—	14,243,051	—	—	19,013,271
Cherokee	14,793,884	—	—	—	—	14,793,884
Chowan	—	—	—	—	—	—
Clay	—	—	—	—	—	—
Cleveland	58,265,081	—	—	—	—	58,265,081
Columbus	55,407,853	—	—	—	—	55,407,853
Craven	7,409,627	10,469,689	—	—	—	17,879,317
Cumberland	—	—	2,589,646	—	—	2,589,646
Currituck	—	—	—	—	—	—
Dare	—	—	—	—	—	—
Davidson	130,792,574	4,187,876	—	—	—	134,980,450
Davie	20,563,479	—	—	—	—	20,563,479
Duplin	88,069,566	—	—	20,440,023	—	108,509,589
Durham	4,314,883	8,323,403	—	—	—	12,638,286
Edgecombe	12,126,574	—	—	—	—	12,126,574
Forsyth	1,785,084	6,281,814	—	—	2,182,104	10,249,002
Franklin	22,124,289	—	—	—	—	22,124,289
Gaston	30,526,654	7,407,305	—	—	—	37,933,960
Gates	—	—	—	—	—	—
Graham	—	—	—	—	—	—
Granville	12,400,088	—	—	—	—	12,400,088
Greene	—	—	—	—	—	—

(continued)

Table B-1. Major Investments in Renewable Energy Across North Carolina Counties (continued)

County Name	Solar	Landfill Gas	Hydro	Biomass	Solar Thermal	Total
Guilford	11,870,686	—	—	—	1,178,046	13,048,733
Halifax	—	—	—	—	—	—
Harnett	27,026,737	—	—	—	—	27,026,737
Haywood	5,814,317	—	—	—	—	5,814,317
Henderson	2,361,248	—	—	—	2,537,331	4,898,578
Hertford	19,576,648	—	—	1,339,292	—	20,915,940
Hoke	—	—	—	—	—	—
Hyde	—	—	—	—	—	—
Iredell	—	8,375,752	—	—	—	8,375,752
Jackson	—	—	—	—	—	—
Johnston	3,400,476	4,187,876	—	—	—	7,588,352
Jones	—	—	—	—	—	—
Lee	—	—	—	—	—	—
Lenoir	39,650,750	—	—	—	—	39,650,750
Lincoln	19,825,375	—	—	—	—	19,825,375
Macon	—	—	—	—	—	—
Madison	—	—	—	—	—	—
Martin	—	—	—	—	—	—
McDowell	—	—	4,585,831	—	—	4,585,831
Mecklenburg	24,366,077	—	—	—	—	24,366,077
Mitchell	—	—	—	—	—	—
Montgomery	—	—	—	—	—	—
Moore	—	—	—	—	—	—
Nash	46,806,080	—	—	—	—	46,806,080
New Hanover	8,892,518	—	—	—	1,051,180	9,943,698
Northampton	—	—	—	—	—	—
Onslow	—	5,111,826	—	—	—	5,111,826
Orange	21,913,289	—	—	—	1,424,530	23,337,819
Pamlico	—	—	—	—	—	—
Pasquotank	—	—	—	—	—	—
Pender	—	—	—	—	—	—
Perquimans	—	—	—	—	—	—
Person	40,438,811	—	—	92,945,202	—	133,384,013
Pitt	—	—	—	—	—	—
Polk	—	—	—	—	—	—
Randolph	3,507,056	—	—	—	—	3,507,056
Richmond	19,825,375	—	—	—	—	19,825,375
Robeson	151,251,540	2,617,422	—	—	15,534,678	169,403,641
Rockingham	20,867,111	—	—	—	—	20,867,111

(continued)

Table B-1. Major Investments in Renewable Energy Across North Carolina Counties (continued)

County Name	Solar	Landfill Gas	Hydro	Biomass	Solar Thermal	Total
Rowan	9,559,759	—	—	1,286,120	—	10,845,879
Rutherford	—	—	—	—	—	—
Sampson	—	16,025,035	—	1,724,901	—	17,749,936
Scotland	42,103,641	—	—	—	—	42,103,641
Stanly	—	—	—	—	—	—
Stokes	—	—	—	—	—	—
Surry	20,301,121	12,301,885	—	—	—	32,603,006
Swain	—	—	—	—	—	—
Transylvania	—	—	—	—	—	—
Tyrrell	—	—	—	—	—	—
Union	19,825,375	—	—	—	—	19,825,375
Vance	19,825,375	—	—	—	—	19,825,375
Wake	73,149,781	16,489,761	—	—	—	89,639,542
Warren	40,388,854	—	—	—	—	40,388,854
Washington	—	—	—	—	—	—
Watauga	9,228,048	—	—	—	—	9,228,048
Wayne	59,476,125	8,323,403	—	—	—	67,799,528
Wilkes	—	—	—	—	—	—
Wilson	19,825,375	—	—	—	—	19,825,375
Yadkin	—	—	—	—	—	—
Yancey	—	—	—	—	—	—
Total	**1,542,051,501**	**218,428,810**	**26,004,358**	**119,431,975**	**25,354,148**	**1,931,270,793**

Note: This table only includes renewable projects with installment costs greater than $1,000,000 (in 2013 dollars). Total renewable investment was $2.06 billion across North Carolina.