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Economic Impact Analysis of Clean Energy Development in North Carolina—2017 Update

Prepared for

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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 2016 report *Economic Impact Analysis of Clean Energy Development in North Carolina—2016 Update*, prepared by RTI International (2016).

In this supplement to the 2016 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 Renewable Energy and Energy Efficiency Portfolio Standard (REPS)[1] requirements.
- Government funds 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 $9,002.1 million was invested in clean energy development in North Carolina between 2007 and 2016, which was supported, in part, by the state government at an estimated cost of $611.7 million. Clean energy investments were nearly 15 times larger than the state incentives for them.

[1] Under this law, investor-owned utilities in North Carolina will be required to meet up to 12.5% of their retail electricity sales through renewable energy resources or energy efficiency measures by 2021. Rural electric cooperatives and municipal electric suppliers are subject to a 10% REPS requirement.

- Renewable energy project investment in 2016 was $2,228.3 million, or 127 times the $17.6 million investment observed in 2007.
- Investment in 2015 and 2016 accounted for 60% of total cumulative investment over the last 10 years.
- Total contribution to gross state product (GSP) was $10,926.9 million between 2007 and 2016 (see **Table ES-1**).
- Clean energy development supported 113,998 annual full-time equivalents (FTEs), equivalent to one person working full time for a year, from 2007 to 2016.
- Duplin, Robeson, and Catawba Counties experienced the greatest amount of investment—more than $300 million each between 2007 and 2016.
- Cumberland, Edgecombe, Rutherford, Bladen, Beaufort, and Wayne Counties each experienced between $200 million and $300 million in investment between 2007 and 2016.

Table ES-1. Total Economic Impacts, 2007–2016

	Total Output[a] (Million, 2013$)	Gross State Product[b] (Million, 2013$)	Employment (Full-Time Equivalents)	Fiscal Impact[c] (Million, 2013$)
Direct economic impact from clean energy development	9,002	5,775	52,045	586
Direct economic impact from change in government spending[d]	−566	−433	−5,695	−15
Secondary economic impact[e]	9,499	5,584	67,648	335
Total economic impact	17,935	10,927	113,998	906

[a] Total output refers to revenue received by North Carolina individuals and businesses.

[b] GSP represents the total value added. Value added is a non-duplicative measure of production that when aggregated across all industries equals GDP. It provides a complimentary indicator to that of final sales. While gross output is a useful measure of an individual industry's output, gross output for the economy as a whole double-counts sales between industries and is a less reliable measure.

[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 $611.7 million in state clean energy incentives, less $45.3 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 2016, investment in clean energy development in North Carolina increased from $47.7 million to $9,002.1 million, of which $7,772.0 million (86%) was for renewable energy projects and $1,230.2 million[2] (14%) was for major energy efficiency initiatives.

The total amount of energy generated or saved through renewable energy and energy efficiency programs amounted to 49.5 million MWh, which is sufficient to power nearly 3.63 million homes for 1 year.[3]

Although the growth in energy generation from renewable sources has been documented in annual energy reports,[4] 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). Since its publication, RTI has published annual updates to capture the economic impacts of new clean energy investment for 2013 (RTI, 2014), 2014 (RTI, 2015), and 2015 (RTI, 2016).

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[2] These data have been revised down from previous reports due to data updates from the NCUC docket system for Duke Energy Carolinas, Duke Progress, and Dominion.

[3] The Energy Information Administration (EIA) estimates that in 2014 a North Carolina residential utility customer consumed 13,629 kWh (or 13.629 MWh) per year. See EIA (2015a): http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3.

[4] For more information on renewable energy generation in the United States, see EIA (2015b): http://www.eia.gov/electricity/annual/?src=Electricity-f4.

This report updates the economic impact results to include clean energy investments made in 2016. Aside from a few minor changes in reporting structure for some data elements of the analysis (see Appendix A), the data and analysis methodology are unchanged.

This work was commissioned by the North Carolina Sustainable Energy Association, a professional and membership 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 previous versions of the report, the principle 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 portion 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 (NC-DOR), the North Carolina Department of Environmental Quality[5] (NC DEQ), and the U.S. Energy Information Administration (EIA);
- Measured spending for clean energy investments made in North Carolina over the 10-year period from 2007 through 2016 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

[5] Formally known as the North Carolina Department of Environment and Natural Resources

conventional energy generation and of government incentives over the study period; and

- Presents the gross employment, fiscal, economic output, and value 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 2016. 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 revenue (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 indirect (supply chain) and induced (consumer spending) impacts resulting from clean energy development.

The total economy-wide impacts represent the combination of the two categories. Analysis results are presented as the cumulative impact from 2007 through 2016; therefore, results should not be interpreted as annual totals.

Unlike other economic impact 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 REPS rider for the renewable energy and energy efficiency portfolio standard.
- How state government funding would have been spent in the absence of state incentives for clean energy development.

However, the analysis does not consider the alternative uses for private 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.[6]

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

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 and 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 estimates gross changes in economic activity associated with all clean energy investment that took place over the study period.

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 13 offices in the United States and 10 in international locations. We employ over 3,036 across the United States, and over 1,687 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.

2 Economic Impacts, 2007–2016

From 2007 through 2016, $7,772.0 million was invested in the construction and installation of renewable energy projects in North Carolina. An additional $1,230.2 million was spent on implementing energy efficiency initiatives.[7] Total clean energy development was valued at $9,002.1 million.

Although investment was distributed across the state, Duplin, Robeson, and Catawba Counties each experienced the greatest amount, with more than $300 million in renewable energy project investment each.

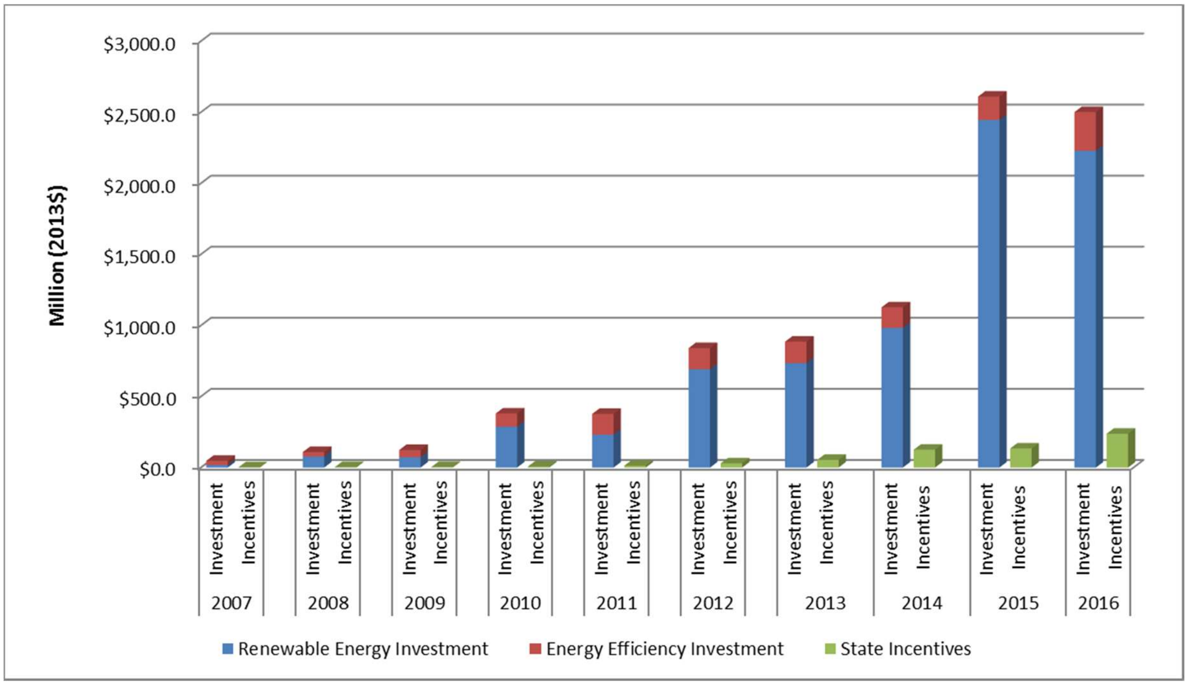
Clean energy development contributed $10,926.9 million in GSP and supported 113,998 annual FTEs statewide. As a result of changes in economic activity from the development of clean energy in North Carolina, state and local governments realized tax revenue of $906.3 million.

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 10-year analysis period. For example, renewable energy project investment in 2016 was $2,228.3 million, which was about 127 times the size of 2007's $17.6 million. The combined clean energy investment for 2015 and 2016 accounts for 60% of the total cumulative clean energy investment from 2007 to 2016.

[7] 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, 2007–2016



See Appendix A for data sources.

Table 2-1. Clean Energy Investment in North Carolina, 2007–2016

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	$17.6	0%	$30.1	2%	$47.7	1%	$1.9
2008	$77.6	1%	$31.5	3%	$109.1	1%	$3.7
2009	$73.1	1%	$50.3	4%	$123.4	1%	$4.3
2010	$288.0	4%	$92.3	8%	$380.2	4%	$7.0
2011	$231.8	3%	$145.4	12%	$377.3	4%	$13.1
2012	$691.9	9%	$148.8	12%	$840.7	9%	$29.7
2013	$735.1	9%	$151.0	12%	$886.1	10%	$54.3
2014	$982.9	13%	$144.2	12%	$1,127.1	13%	$125.7
2015	$2,445.7	31%	$163.9	13%	$2,609.6	29%	$134.3
2016	$2,228.3	29%	$272.6	22%	$2,500.9	28%	$237.6
Total	$7,772.0	100%	$1,230.2	100%	$9,002.1	100%	$611.7

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 15 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.

It is also important to note that some of the historic values in Table 2-1 have changed slightly from previous versions of this report due primarily to updating data sources. Overall, our methodology remains the same between different versions of the report make them as comparable as possible.

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 Environmental Quality; North Carolina Utility Commission (NCUC) dockets for individual projects; North Carolina GreenPower; 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 2016. Investment in renewable energy projects totaled $7,772.0 million. Investment in energy efficiency totaled $1,230.2 million. Thus, total clean energy investment was $9,002.1 million during the study period.

Of the $7,772.0 million investment in renewable energy projects,

- Solar photovoltaics made up $6,410.3 million (82%),
- Biomass made up $628.4 million (8%), and
- Wind made up $388.9 million (5%).

Table 2-2. Direct Spending in Clean Energy Development by Technology, 2007–2016

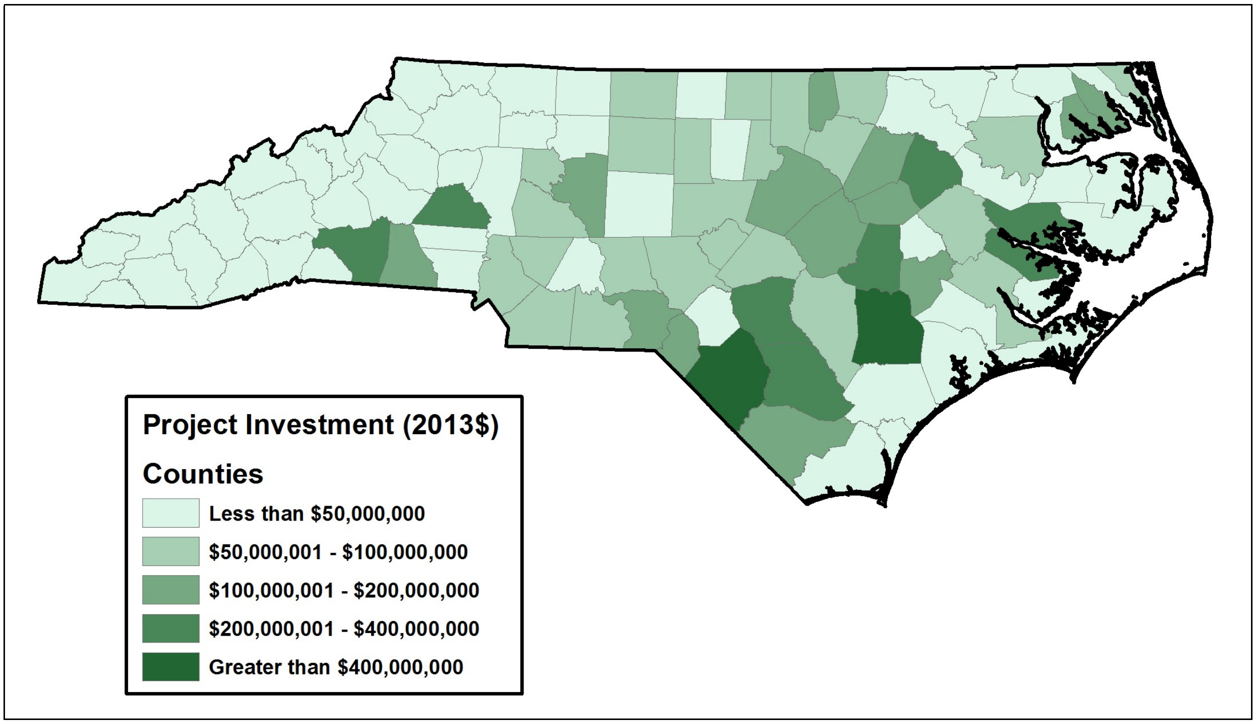
Category	Technology	Value (Million, 2013$)	%
Renewable energy direct investment	Biogas fuel cell	$70.5	1%
	Biomass	$628.4	8%
	Geothermal	$29.6	0%
	Hydroelectric (<10 MW capacity)	$25.3	0%
	Landfill gas	$169.9	2%
	Passive solar	$7.9	0%
	Solar photovoltaic	$6,410.3	82%
	Solar thermal	$41.4	1%
	Wind	$388.9	5%
	Total	$7,772.0	100%
Energy efficiency direct investment	Utility energy efficiency and demand-side management programs	$931.4	76%
	Utility Savings Initiative	$298.8	24%
	Total	$1,230.2	100%
Total		$9,002.1	

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. The figure including all eligible wind, landfill gas, biomass, hydroelectric, solar photovoltaics, and solar thermal projects valued over $1 million. These projects account for renewable energy investment of approximately $7,634.2 million (98% of the total $7,772.0 million in renewable investment over the period).

Duplin, Robeson, and Catawba Counties each experienced more than $300 million in renewable energy project investment from 2007 through 2016. Cumberland, Edgecombe, Rutherford, Bladen, Beaufort, and Wayne Counties each experienced between $200 million and $300 million in investment between 2007 and 2016.

Figure 2-2. Distribution of Renewable Energy Projects Valued at $1 Million or Greater across North Carolina Counties, 2007-2016



See also Appendix B.

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 2016.

Table 2-3. Cumulative Renewable Energy Generation, 2007–2016

Technology	Facilities		Energy Equivalent Generated	
	Number	%	Thousand MWh	%
Biogas fuel cell	1	0%	99	1%
Biomass (including combined heat and power)	24	1%	9,548	51%
Geothermal	1,376	47%	107	1%
Hydroelectric (<10 MW capacity)	3	0%	341	2%
Landfill gas	20	1%	2,723	14%
Passive solar	N/A	N/A	6	0%
Solar photovoltaic	1,382	48%	5,855	31%
Solar thermal	83	3%	131	1%
Wind	10	0%	3[a]	0%
Total	2,899	100%	18,813	100%

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

[a] The 208MW capacity Amazon Wind Farm U.S. East became operational at the very end of 2016, so while there was no energy generated from the plant in 2016 the analysis does capture the investment for this facility.

Table 2-4. Energy Efficiency Energy Savings, 2007–2016

Program	Energy Saved (Thousand MWh)	Energy Costs Saved (Million, 2013$)
Utility Programs[a]	19,373	$1,162.4
Utility Savings Initiative[b]	11,348	$1,068.4
Total	30,721	$2,230.8

[a] Energy cost savings were estimated using an estimate of $0.06/kWh for years 2007 through 2016 for Utility Programs.[8]

[b] Energy savings and costs savings from USI was provided through data from personal communications with the USI team.

[8] Avoided costs received by qualified facilities vary by utility and length of contract. These values represent a central value among those reported in avoided cost schedules to NCUC.

Renewable energy facilities generated 18.8 million MWh of energy, of which

- 51% was biomass,
- 14% was landfill gas, and
- 31% was solar photovoltaics.

Energy efficiency initiatives also produced large savings in North Carolina. Energy efficiency programs run by utility companies saved 19.4 million MWh of energy during the study period. The Utility Savings Initiative, a government-run energy efficiency program, documents savings of $1,068.4 million on energy expenses.[9]

Thus, the total energy generated or saved from clean energy projects is estimated to amount to at least 49.5 million MWh.

2.1.3 State Incentives for Clean Energy Investment

State incentives for clean energy investment, including the renewable energy investment tax credit[10] 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 appropriations, renewable energy projects received $597.7 million in tax credits and energy efficiency projects received $14 million. Total government expenditures were $611.7 million between 2007 and 2016 (**Table 2-5**).

For the purpose of this study, it was assumed that the money the government spent on renewable energy and energy efficiency programs was not spent on other government services. Thus, the government programs contributed to the

[9] As of 2016, state institutions are only required to report their energy savings biennially, so a full report was not available as in previous years. Data from the University of North Carolina system were available for 2016 and were provided to RTI by the USI team. Avoided cost numbers were used to estimate total state energy cost savings by assuming the ratio of the UNC system to the total state savings was constant across years. To convert sums to 2013 U.S. dollars, we applied inflation multipliers calculated from the CPI-U (see Table A-3).

[10] This credit expired at the end of 2015. Systems installed in 2016 or later will not qualify for this credit. Senate Bill 372, signed in April 2015, provides a delayed sunset of the tax credit for projects that meet certain criteria and received pre-approval from the Department of Revenue.

positive investment in renewable energy and energy efficiency of $9,002.1 million.

However, the $611.7 million spent on renewable energy and energy efficiency programs 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.

Table 2-5. State Incentives for Clean Energy Development, 2007–2016

Year	Renewable Energy Investment Tax Credit[a,b] (Million, 2013$)	Energy Efficiency[c,d] (Utility Savings Initiative, Million, 2013$)	Total (Million, 2013$)
2007	$0.5	$1.4	$1.9
2008	$2.3	$1.4	$3.7
2009	$2.9	$1.4	$4.3
2010	$5.6	$1.4	$7.0
2011	$11.7	$1.4	$13.1
2012	$28.3	$1.4	$29.7
2013	$52.9	$1.4	$54.3
2014	$124.3	$1.4	$125.7
2015	$132.9	$1.4	$134.3
2016	$236.2	$1.4	$237.6
Total	**$597.7**	**$14.0**	**$611.7**

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.

[a] North Carolina Department of Revenue, Policy Analysis and Statistics Division. (2007-2016). Unaudited NC-478G. Raleigh, NC: North Carolina Department of Revenue, Policy Analysis and Statistics Division.

[b] North Carolina Department of Revenue, Revenue Research Division. (2017). "Credit for Investing in Renewable Energy Property Processed during Calendar Year 2016." Raleigh, NC: North Carolina Department of Revenue, Revenue Research Division.

[c] North Carolina Department of Commerce. (November 1, 2015). "Annual Report for the Utility Savings Initiative for Fiscal Year July 1, 2014–June 30, 2015." Raleigh, NC: North Carolina Department of Commerce.

[d] North Carolina Department of Environmental Quality. (May 1, 2017). Personal Communication.

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 development 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.

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.

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

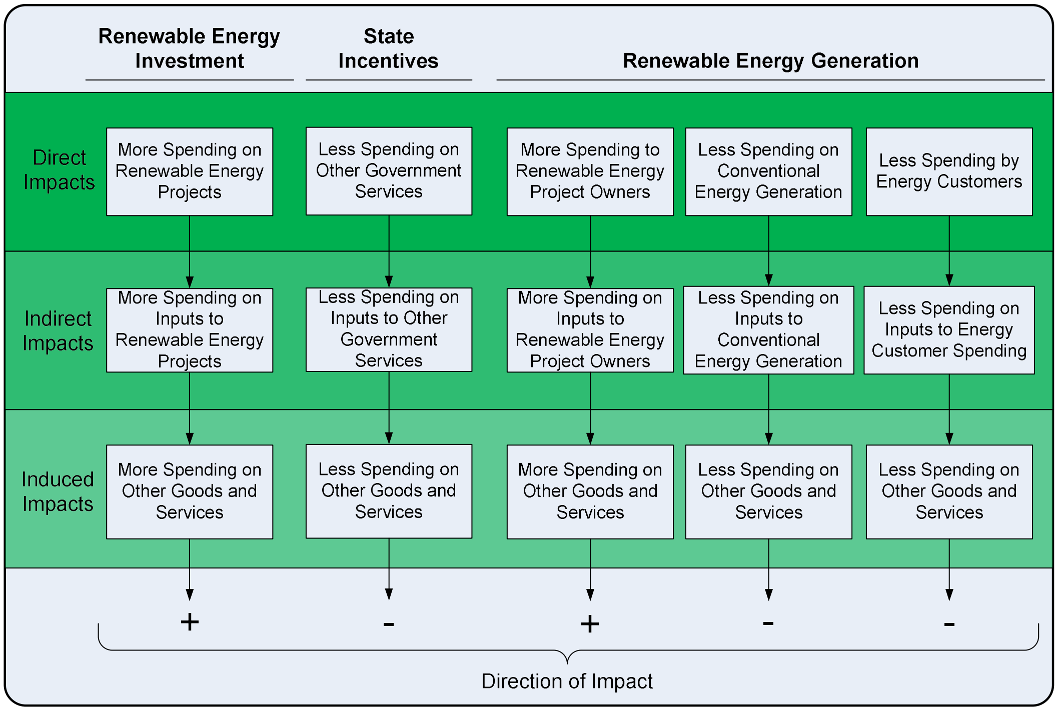
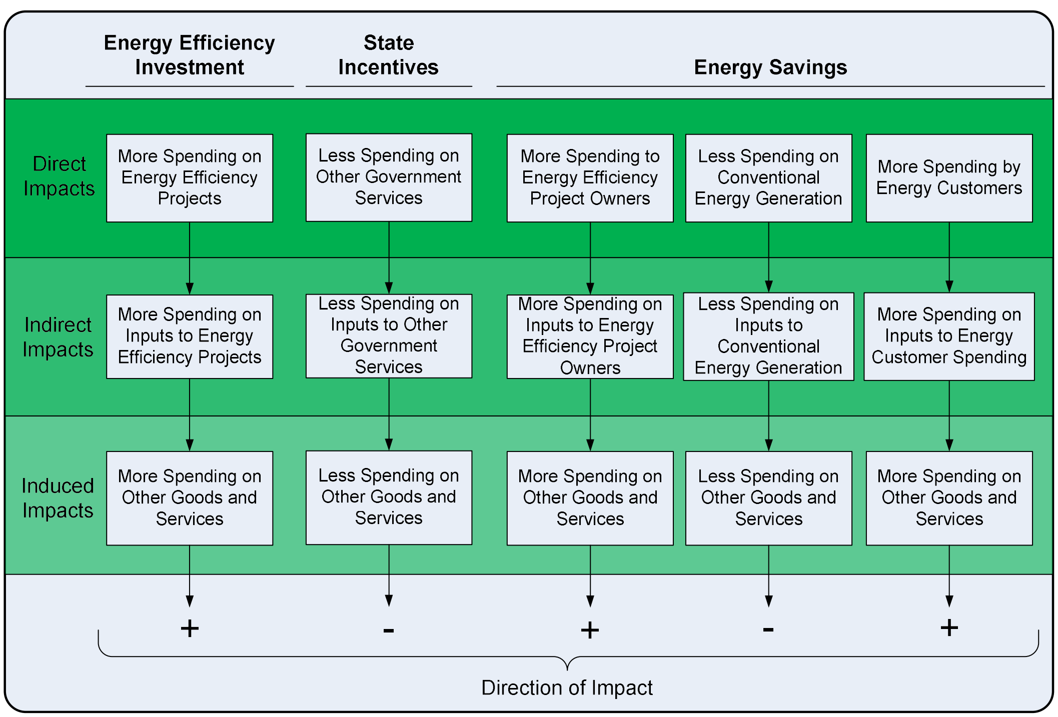


Figure 2-4. Energy Efficiency Direct, Indirect, and Induced Economic Impacts Related to Clean Energy Incentives



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 was assumed to receive $0.06/kWh[11] in avoided costs for the years 2007 through 2016, 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 ($0.0675/kWh for industrial and $0.1028/kWh for commercial and residential customers [EIA, 2015c]). 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 18.8 million MWh of energy over the study period. This generation is estimated to have resulted in a total of $1,163.4 million[12] 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 $410 million.[13]

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 were calculated. These avoided costs were modeled as a transfer from the inputs of conventional energy generation to utility customers, in line with Duke Energy's Save-A-Watt

[11] 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.

[12] This $1,163.4 million was calculated by multiplying 14,415,450 MWh generated by non-thermal renewable projects by $60/MWh avoided cost to yield $864,926,997. The 3,919,392 industrial thermal MWh generated was multiplied by industrial retail savings of $67.5/MWh (EIA, 2015b) to yield $264,558,960. Lastly, the 244,160 commercial and residential thermal MWh generated was multiplied by the average retail savings of $102.8/MWh (EIA, 2015c) to yield $25,099,611. Summing the three totals together yields $1,154,585,568.

[13] This total was estimated using the most recent REPS cost data available at the time of the analysis.

program and current energy efficiency and demand response cost recovery mechanism.[14] Energy savings from the Utility Savings Initiative were a 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 30.7 million MWh in energy savings over the study period. The avoided cost for these programs, assuming $0.06/kWh was $1,162.4 million.[15] Combining this with the $1,068.4 million saved by the Utility Savings Initiative yields a total energy efficiency savings of $2,230.8 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 $17,934.6 million over the 10-year period from 2007 to 2016. Clean energy development accounted for $10,926.9 million in GSP over the study period. Total employment effects were estimated to be 113,998 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**, $7,772 million in in-state spending on renewable energy projects has a direct impact on GSP ($5,203.5 million), employment (46,893 FTEs), and state and local tax revenue ($556.7 million).

These renewable projects received an estimated $597.7 million in state tax credits between 2007 and 2016. Because in the absence of the incentive program, the state government would have spent the money on other government services, there is an offsetting direct economic impact that must be considered.

According to IMPLAN's assumptions, out of the $597.7 million in state tax credits, the state government would have otherwise spent $553.5 million on in-state goods and services and spent

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[14] 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. The "Shared Savings Mechanism" replaced the Save-A-Watt program effective January 1, 2014, and is reflected in this update.

[15] The avoided cost was calculated by multiplying 19,373,482 MWh by $60/MWh ($0.06/kWh) avoided cost to yield $1,162.4 million.

$44.2 million out-of-state for goods and services. Therefore, the direct economic impact from the change in government spending patterns is −$553.5 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.

Table 2-6. Renewable Energy Projects Economic Impacts, 2007–2016

	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	7,772	5,203.5	46,893	556.7
Direct economic impact from change in government spending[c]	−553.5	−422.7	−5,565	−14.7
Secondary economic impact	7,063.9	4,071.6	45,032	327.5
Total economic impact	14,282.4	8,852.4	86,359	869.5

[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 $597.7 million in renewable tax credits, less $44.2 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 $8,852.4 million, 86,359 FTEs, and $869.5 million in state and local tax revenue.[16]

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 $1,230.2 million in energy efficiency investment, and the resulting energy savings and changes in spending over the

[16] 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.

study period contributed $2,074.4 million to total GSP and supported 27,639 FTEs.

Table 2-7. Energy Efficiency Initiatives Economic Impacts, 2007–2016

	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	1,230.2	571.9	5,152	29.3
Direct economic impact from change in government spending[c]	−13	−9.9	−130	−0.3
Secondary economic impact	2,434.9	1,512.4	22,617	7.8
Total economic impact	3,652.1	2,074.4	27,639	36.8

[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 $14 million in state government procurement to the Utility Savings Initiative, less $1 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 $14 million on other government services, $1 million would have been spent out of state (second data row in Table 2-7).

The overall fiscal impact from energy efficiency incentives becomes positive in 2016 due to a large increase in the number of energy efficiency RECs issued in 2015 and 2016 (which was not fully captured in the 2015 version of this report due to underestimation). The 2008–2014 period saw a cumulative total of 7.4 million MWh of credits while 2015–2016 had an estimated 12 million MWh of credits issued (NC-RETS, 2017).

2.3.3 Total Impact Associated with Clean Energy Projects

For 2007 through 2016, the total economic activity associated with renewable energy projects and energy efficiency initiatives was (**Table 2-8**):

- $17,934.6 million in gross output (revenue),
- $10,926.9 million in GSP (value-added),
- 113,998 FTEs, and

- $906.3 million in state and local tax revenues.

Table 2-8. Total Economic Impacts, 2007–2016

	Total Output[a] (Million, 2013$)	Gross State Product[b] (Million, 2013$)	Employment (Full-Time Employee Equivalents)	Fiscal Impacts (Million, 2013$)
Direct economic impact	9,002.1	5,775.4	52,045	586
Direct economic impact from change in government spending[c]	−566.4	−432.6	−5,695	−15
Secondary economic impact	9,498.9	5,584.1	67,648	335.3
Total economic impact	17,934.6	10,926.9	113,998	906.3

[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 $611.7 million in state clean energy incentives, less $45.3 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.

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 $566.4 million. It should be noted that these losses are due to a reduction in 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 $906.3 million as a result of gross changes in economic activity.

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Appendix A: Technical Appendix

A.1 RENEWABLE TECHNOLOGY DATA SOURCES AND ASSUMPTIONS

A.1.1 Solar Photovoltaic

Installed solar photovoltaic capacity between 2007 and 2016 was estimated based on data from North Carolina Renewable Energy Tracking System (NC-RETS, 2017), and North Carolina GreenPower (North Carolina GreenPower, personal communication, April 10, 2017). It is important to note that while these data sources capture most of the installed renewable energy capacity in North Carolina, they are not intended to be comprehensive in their coverage. NCRETS was established by the NCUC to issue and track renewable energy certificates (RECs). Utilities use the tracking system to demonstrate compliance with the State's REPS policy. If renewable energy producers chose not to register with NCRETS their installed capacity and subsequent investment is not captured in this economic impact analysis nor is it included in the Appendix B tables reporting renewable investments by county and state legislative districts.

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 period (NREL, 2012a), we developed cost estimates for installations by size of system and year of installation. These estimates rely on projected photovoltaic project costs from developers through December 31, 2016, that the North Carolina Sustainable Energy Association (NCSEA) compiled from the North Carolina Utilities Commission (NCUC). 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 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], 2017).

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. Annual fixed operating and maintenance (O&M) costs were assumed to be $26/kW.

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	15,791				
2007	10,298	9,114			
2008	10,622	10,672	12,025		
2009	9,942	9,407	7,017		
2010	8,850	7,644	5,889	5,355	
2011	8,195	6,652	5,952	5,417	3,781
2012	7,841	6,320	5,126	4,676	4,087
2013	6,799	4,850	3,271	3,185	3,365
2014	6,260	4,798	3,137	2,433	2,956
2015	6,435	3,854	3,173	2,878	2,776
2016	5,537	4,221	2,764	2,767	2,726

A.1.2 Landfill Gas

Capacity for landfill gas (LFG) facilities was estimated using data from NC-RETS (2017) 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, 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 (2017) 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 O&M costs of $43 per MWh (EIA, 2013a, 2013c).

A.1.3 Hydroelectric

NC-RETS (2017) represents the universe from which we pulled specific hydroelectric projects. Because NC-RETS tracks only hydroelectric projects under 10 MW, our analysis may underestimate total hydroelectric investment over the study period. RTI estimated new or incremental capacity at hydroelectric facilities between 2007 and 2016 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 2016 was estimated using data from NC-RETS (2017) 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 (2017) 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 (2017), North Carolina GreenPower (personal communication, April 10, 2017), and one 208MW system added via press release (ELP, 2017). Cost for new wind investment were included in 2016 totals because construction was completed by year end but did not generate electricity until 2017. Hence there is no major increase in the generation total for wind power (see Table 2-3). 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 2016 are based on data reported in NC-RETS (2017). 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 for 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 Environmental Quality (NCDEQ) provided permit data for geothermal wells (NCDEQ, personal communication, April 7, 2017). 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 North Carolina Department of Revenue (2007–2016) 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 North Carolina 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 2016 were developed from figures provided by the North Carolina Department of Revenue (2011b, 2012a, 2013, 2014, 2015, 2016).

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, $69.75/MWh (EIA, 2016). For geothermal, solar thermal, and passive solar, we assumed that the cost of energy saved is the average retail price for electricity, $102.80/MWh (EIA, 2016).

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, 2013b, 2014, 2015a, 2017; Progress, 2009b, 2010a, 2011b, 2012a, 2013a, 2014, 2015a, 2016; GreenCo, 2010a, 2010c, 2012a, 2012b, 2013, 2014, 2015, 2016; ElectriCities, 2009, 2010, 2011a, 2012a, 2013a, 2014, 2015, 2016) 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.

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

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

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-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
2014	236.38	0.99
2015	237.03	0.98
2016	240.01	0.97

Source: BLS, 2017.

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 2016 for Dominion North Carolina Power (2010, 2011, 2012, 2013, 2014, 2015b, 2016), Duke Energy Carolinas (2016, 2017), NC GreenCo (2010b), NCMPA1 and NCEMPA (ElectriCities, 2011b; 2011c; 2011d; 2011e; 2011f; 2011g; 2012b; 2012c; 2013b; 2013c), and Progress (2008, 2009a, 2010b, 2011a, 2012b, 2016). Demand-side management program costs were only included for 2011 through 2016 because these programs could not pass along costs to consumers until 2011 (General Assembly, 2011).

Energy savings associated with utility programs between 2007 and 2016 were estimated based on NC-RETS data (2017). Energy savings from utility programs in 2016 were estimated from expected 2016 savings from NCUC dockets. 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
Residential Lighting Program	Dominion

(continued)

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

Program	Utility
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
Residential Appliance Recycling	Progress

(continued)

Table A-4. Utility Energy Efficiency Programs

Program	Utility
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 2015 annual report (North Carolina Department of Commerce, 2015). The USI no longer is required to report annually. Data for 2016 were created using an estimate from partial USI data for 2016 provided through personal communications.

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), 2013 IMPLAN default data for North Carolina (MIG Inc., 2015), and original assumptions where necessary (**Table A-5**).

In the updated version of IMPLAN, many sectors have been disaggregated to include different subsectors. The most relevant of those for this study is the energy generation sector. Previously, energy generation was a single sector that captured all energy generation technologies. In the 2013 version of IMPLAN, the energy sector is broken out into a traditional fossil fuel sector and six separate renewable energy sectors.

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.

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 the JEDI Photovoltaic model (NREL, 2012c) according to the installation size.	The avoided cost of energy produced was transferred to Sector 446, Lessors of Non-financial Intangible Assets (Regulatory Assistance Project, 2005) from inputs to Sector 44, Electrical power generation—solar.
Hydroelectric	Investment spending was allocated to IMPLAN Sector 54, Construction of Other New Nonresidential Structures.	Avoided cost net of fixed and variable O&M costs was transferred to Sector 446, Lessors of Non-financial intangible Assets (Regulatory Assistance Project, 2005) from inputs to Sector 41, Electrical power generation—Hydroelectric. Fixed and variable O&M costs were allocated to IMPLAN Sector 62, 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 446, Lessors of Non-financial Intangible Assets (Regulatory Assistance Project, 2005) from inputs to Sector 47, Electrical power generation—Biomass. 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.

(continued)

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

Type	Direct Spending	Secondary Effects
Renewable Energy (cont.)		
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 446, Lessors of Non-financial Intangible Assets (Regulatory Assistance Project, 2005) from inputs to Sector 47 Electrical power generation—Biomass. 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.
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 446, Lessors of Non-financial Intangible Assets (Regulatory Assistance Project, 2005) from inputs to Sector 47 Electrical power generation—Biomass. 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 446, Lessors of Non-financial Intangible Assets (Regulatory Assistance Project, 2005) from inputs to Sector 45, Electrical power generation—wind. 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 446, Lessors of Non-financial Intangible Assets (Regulatory Assistance Project, 2005) from inputs to Sector 48, Electric power generation—all other. Fixed O&M costs were allocated based on the Landfill Gas IMPLAN distribution in the 2009 Bipartisan Policy Center report.

(continued)

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

Type	Direct Spending	Secondary Effects
Renewable Energy (cont.)		
Geothermal Heat Pumps	Investment spending was allocated 50% to Sector 277, Air Conditioning, Refrigeration, and Warm Air Heating Equipment Manufacturing, 25% to Sector 54, Construction of Other New Non-residential Structures, and 25% to Sector 395, 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 42, Electrical power generation—fossil fuels. Fixed O&M costs were allocated to IMPLAN Sector 62, Maintenance and Repair Construction of Non-residential Structures.
Passive Solar	Investment spending was allocated to Sector 59, 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 42, Electricity, Generation, Transmission, and Distribution.
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 42, Electricity, Generation, Transmission, and Distribution. Fixed O&M costs were allocated to IMPLAN Sector 62, Maintenance and repair construction of non-residential structures.
REPS Rider		REPS rider was transferred to Sector 446, 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.

(continued)

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

Type	Direct Spending	Secondary Effects
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 471, Waste Management and Remediation Services, and 90% to Sector 395, Wholesale Trade Businesses. For school education programs, we distributed spending across 100% to Sector 460, All Other Miscellaneous Professional, Scientific and Technical Services.	The avoided cost of energy saved was transferred 50% to Sector 446, 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 42, Electrical power generation—fossil fuels.
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 42, Electrical power generation – fossil fuels.
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.

A.4 DIFFERENCES FROM LAST YEAR'S REPORT

The results of this analysis differ from last year's *Economic Impact Analysis of Clean Energy Development in North Carolina—2016 Update* (RTI, 2016). The list below outlines several changes to the underlying data, study scope, and reporting conventions that may lead to differences between the reports.

- The study frame was expanded to include 2016, whereas the last report's study frame was 2007 to 2015.

- Differences in yearly renewable energy investment can be explained by the availability of new data on the timing of photovoltaic investments from North Carolina GreenPower, the addition of new renewable energy projects in the NC-RETS database and filings at the North Carolina Utilities Commission that were not present at the time of the 2015 report, updated geothermal data from NCDEQ, updated data for estimating passive solar investments, and increased data on photovoltaic costs per kW.
- 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 2016 report estimated 2015 tax credits taken, this study used retrospective data provided by the North Carolina Department of Revenue for this year's tax credits.
- Differences in the overall decrease of investment in energy efficiency are explained through updates to data sources for utility demand side management and energy efficiency programs. The data were updated for Duke Energy Carolinas, Duke Progress, and Dominion. In several cases, previous years' estimates needed to be revised down.

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Appendix B: Renewable Energy Projects Valued at $1 Million or Greater by County and NC State Legislative Districts

Table B-1. Major Investments in Renewable Energy Across North Carolina Counties (Millions 2013$)

County Name	Biomass	Hydro	Landfill Gas/ Fuel Cell	Solar Photovoltaic	Solar Thermal	Wind	Grand Total
Alamance	–	–	–	82.7	–	–	82.7
Alexander	–	–	–	20.2	–	–	20.2
Alleghany	–	–	–	–	–	–	–
Anson	–	–	–	53.3	–	–	53.3
Ashe	–	–	–	–	–	–	–
Avery	–	–	–	4.9	–	–	4.9
Beaufort	–	–	–	216.9	–	–	216.9
Bertie	1.6	–	–	87.1	–	–	88.8
Bladen	–	–	–	233.0	–	–	233.0
Brunswick	46.5	–	–	–	–	–	46.5
Buncombe	–	–	3.6	23.2	–	–	26.7
Burke	–	4.4	–	21.4	–	–	25.8
Cabarrus	6.2	–	–	37.0	15.1	–	58.3
Caldwell	–	–	–	3.1	–	–	3.1
Camden	–	–	–	–	–	–	–
Carteret	–	–	–	–	–	–	–
Caswell	–	–	–	44.0	–	–	44.0
Catawba	–	–	70.5	306.5	–	–	377.0
Chatham	–	13.5	–	37.2	–	–	50.7
Cherokee	–	–	–	19.7	–	–	19.7
Chowan	–	–	–	–	–	–	–
Clay	–	–	–	–	–	–	–
Cleveland	–	–	–	184.7	–	–	184.7
Columbus	–	–	–	121.3	–	–	121.3
Craven	–	–	11.0	59.6	–	–	70.6
Cumberland	–	2.6	–	275.0	–	–	277.6
Currituck	–	–	–	54.6	–	–	54.6
Dare	–	–	–	–	–	–	–
Davidson	–	–	4.2	123.8	–	–	127.9
Davie	–	–	–	88.9	–	–	88.9
Duplin	364.9	–	–	370.9	–	–	735.8
Durham	–	–	8.5	50.3	–	–	58.7
Edgecombe	–	–	–	247.0	–	–	247.0
Forsyth	–	–	6.1	19.1	2.2	–	27.4
Franklin	–	–	–	80.6	–	–	80.6
Gaston	–	–	7.2	29.3	–	–	36.5
Gates	–	–	–	13.6	–	–	13.6

(continued)

Table B-1. Major Investments in Renewable Energy Across North Carolina Counties (Millions 2013$) (continued)

County Name	Biomass	Hydro	Landfill Gas/ Fuel Cell	Solar Photovoltaic	Solar Thermal	Wind	Grand Total
Graham	–	–	–	–	–	–	–
Granville	–	–	–	92.2	–	–	92.2
Greene	–	–	–	36.4	–	–	36.4
Guilford	–	–	–	67.6	1.2	–	68.8
Halifax	–	–	–	8.7	–	–	8.7
Harnett	–	–	–	82.3	–	–	82.3
Haywood	–	–	–	10.1	–	–	10.1
Henderson	–	–	–	12.6	2.7	–	15.3
Hertford	1.3	–	–	19.6	–	–	20.9
Hoke	–	–	–	34.2	–	–	34.2
Hyde	–	–	–	–	–	–	–
Iredell	–	–	8.5	13.2	–	–	21.7
Jackson	–	–	–	–	–	–	–
Johnston	–	–	3.9	170.9	–	–	174.8
Jones	–	–	–	13.2	–	–	13.2
Lee	–	–	–	67.2	–	–	67.2
Lenoir	–	–	–	122.5	–	–	122.5
Lincoln	–	–	–	30.0	–	–	30.0
Macon	–	–	–	–	–	–	–
Madison	–	–	–	–	–	–	–
Martin	–	–	–	–	–	–	–
McDowell	–	4.4	–	–	–	–	4.4
Mecklenburg	37.9	–	32.9	18.3	–	–	89.2
Mitchell	–	–	–	–	–	–	–
Montgomery	–	–	23.1	69.1	–	–	92.2
Moore	–	–	–	74.0	–	–	74.0
Nash	–	–	–	173.4	–	–	173.4
New Hanover	–	–	–	14.0	1.0	–	15.0
Northampton	–	–	–	–	–	–	–
Onslow	–	–	4.8	34.9	–	–	39.7
Orange	–	–	–	45.9	1.4	–	47.3
Pamlico	–	–	–	–	–	–	–
Pasquotank	–	–	–	–	–	194.1	194.1
Pender	–	–	–	–	–	–	–
Perquimans	–	–	–	–	–	194.1	194.1
Person	46.5	–	–	51.6	–	–	98.1
Pitt	–	–	–	56.3	–	–	56.3
Polk	–	–	–	–	–	–	–

(continued)

Table B-1. Major Investments in Renewable Energy Across North Carolina Counties (Millions 2013$) (continued)

County Name	Biomass	Hydro	Landfill Gas/ Fuel Cell	Solar Photovoltaic	Solar Thermal	Wind	Grand Total
Randolph	–	–	–	31.4	–	–	31.4
Richmond	–	–	–	181.4	–	–	181.4
Robeson	115.0	–	2.5	443.5	–	–	561.0
Rockingham	2.3	–	2.0	75.9	–	–	80.1
Rowan	1.3	–	–	62.9	–	–	64.3
Rutherford	–	–	–	242.4	–	–	242.4
Sampson	1.7	–	15.5	43.8	–	–	61.0
Scotland	–	–	–	193.3	–	–	193.3
Stanly	–	–	–	27.1	–	–	27.1
Stokes	–	–	–	10.6	–	–	10.6
Surry	–	–	11.5	20.1	–	–	31.6
Swain	–	–	–	–	–	–	–
Transylvania	–	–	–	–	–	–	–
Tyrrell	–	–	–	–	–	–	–
Union	–	–	–	57.2	–	–	57.2
Vance	–	–	–	134.1	–	–	134.1
Wake	–	–	15.4	107.6	–	–	123.0
Warren	–	–	–	87.7	–	–	87.7
Washington	–	–	–	–	–	–	–
Watauga	–	–	–	–	–	–	–
Wayne	–	–	8.3	197.9	–	–	206.2
Wilkes	–	–	–	–	–	–	–
Wilson	–	–	–	166.2	–	–	166.2
Yadkin	–	–	–	22.4	–	–	22.4
Yancey	–	–	–	–	–	–	–
Total	**625.2**	**25.0**	**239.5**	**6,332.6**	**23.6**	**388.2**	**7,634.2**

Note: This table only includes renewable projects with installment costs greater than $1,000,000 (in 2013 dollars). Total renewable investment was $7.8 billion across North Carolina.

Figures 2-2, B-1, B-2, and B-3 illustrate the geographic distribution of renewable energy projects individually valued at $1 million or greater aggregated to North Carolina counties, Senate and House districts, and the U.S. Congressional House districts. The figures include all eligible wind, landfill gas, biomass, hydroelectric, solar photovoltaics, and solar thermal projects. These projects account for renewable energy investment of approximately $7,634 million (98% of the total $7,772 million in renewable investment over the period).

Senate districts 1, 3, 4, 10, 13, 25, and 42 had the most investment with over $300 million of investment each.

House districts 5, 21, 32, 47, and 66 had over $300 million in investment, while several had between $200 and $300 million, including 1, 4, 22, 23, 25, 45, 48, 89, and 112. All of the House districts mentioned are located either partially or completely in the previously mentioned senate districts.

Readers may note some differences in the geographic allocation of renewable energy investments in this year's report compared to previous years. These differences are the result of changes in the data used to determine the location of renewable energy investments. RTI has historically relied on mailing address (when available) or information gleaned from project names as a proxy for location. This year RTI relied on lat/long data provided by NCSEA to determine project location. RTI mapped the lat/long coordinates reported in the NCSEA database to the RTI database developed for this study. While the lat/long coordinates provide a more precise indication of project location, it has resulted in some shifts in the county or district where the project investment is reported compared to reports from previous years. In the case of large project footprints, it is possible that a proportion of the project is located in an adjacent county or district. It is important to note that the location of the investment does not impact the results of the economic impact analysis, which is conducted at a state level.

RTI and NCSEA still maintain two separate databases of renewable energy facilities and RTI has endeavored to only use NCSEA data to augment missing information. NCSEA has developed its database using publically available data filed at the North Carolina Utilities Commission for all facilities who have filed a Report of Proposed Construction or Certificate of Public Convenience and Necessity, whereas RTI primarily relies on aggregate data from facilities who have registered to create, track, and manage renewable energy certificates (RECs) with NC-RETS. Facilities that have not registered with NC-RETS may not be captured in the RTI database or in this economic impact analysis.

Table B-2. Major Investments in Renewable Energy Across North Carolina Senate Districts (Millions 2013$)

NC Senate District	Biomass	Hydro	Landfill Gas/ Fuel Cell	Solar Photovoltaic	Solar Thermal	Wind	Total
1	–	–	–	285.1	–	388.2	673.3
2	–	–	11.0	59.6	–	–	70.6
3	2.9	–	–	353.7	–	–	356.6
4	–	–	–	396.7	–	–	396.7
5	–	–	8.3	124.0	–	–	132.3
6	–	–	4.8	48.1	–	–	52.9
7	–	–	–	289.2	–	–	289.2
8	46.5	–	–	233.0	–	–	279.5
9	–	–	–	14.0	1.0	–	15.0
10	366.6	–	19.5	535.3	–	–	921.4
11	–	–	–	218.1	–	–	218.1
12	–	–	–	155.1	–	–	155.1
13	115.0	–	2.5	564.8	–	–	682.3
14	–	–	–	26.3	–	–	26.3
15	–	–	–	6.2	–	–	6.2
16	–	–	–	9.8	–	–	9.8
17	–	–	15.4	10.3	–	–	25.7
18	–	–	–	135.7	–	–	135.7
19	–	2.6	–	275.0	–	–	277.6
20	–	–	8.5	115.0	–	–	123.4
21	–	–	–	34.2	–	–	34.2
22	46.5	–	–	123.2	–	–	169.6
23	–	13.5	–	83.1	1.4	–	98.0
24	–	–	–	96.3	–	–	96.3
25	–	–	–	489.4	–	–	489.4
26	2.3	–	2.0	85.5	–	–	89.8
27	–	–	–	56.0	1.2	–	57.2
28	–	–	–	2.0	–	–	2.0
29	–	–	–	91.7	–	–	91.7
30	–	–	11.5	30.7	–	–	42.2
31	–	–	–	37.3	–	–	37.3
32	–	–	6.1	4.2	2.2	–	12.5
33	–	–	27.3	192.9	–	–	220.2
34	1.3	–	8.5	130.8	–	–	140.6
35	–	–	–	57.2	–	–	57.2
36	6.2	–	28.3	37.0	15.1	–	86.6
37	–	–	–	–	–	–	–

(continued)

Table B-2. Major Investments in Renewable Energy Across North Carolina Senate Districts (Millions 2013$) (continued)

NC Senate District	Biomass	Hydro	Landfill Gas/ Fuel Cell	Solar Photovoltaic	Solar Thermal	Wind	Total
38	21.1	–	–	18.3	–	–	39.4
39	–	–	–	–	–	–	–
40	16.9	–	–	–	–	–	16.9
41	–	–	4.6	–	–	–	4.6
42	–	–	70.5	326.7	–	–	397.2
43	–	–	7.2	10.7	–	–	17.9
44	–	–	–	48.6	–	–	48.6
45	–	–	–	8.0	–	–	8.0
46	–	4.4	–	206.0	–	–	210.5
47	–	4.4	–	242.4	–	–	246.8
48	–	–	–	22.8	2.7	–	25.4
49	–	–	3.6	13.0	–	–	16.6
50	–	–	–	29.8	–	–	29.8
Total	**625.2**	**25.0**	**239.5**	**6,332.6**	**23.6**	**388.2**	**7,634.2**

Figure B-1. NC Senate Districts Map

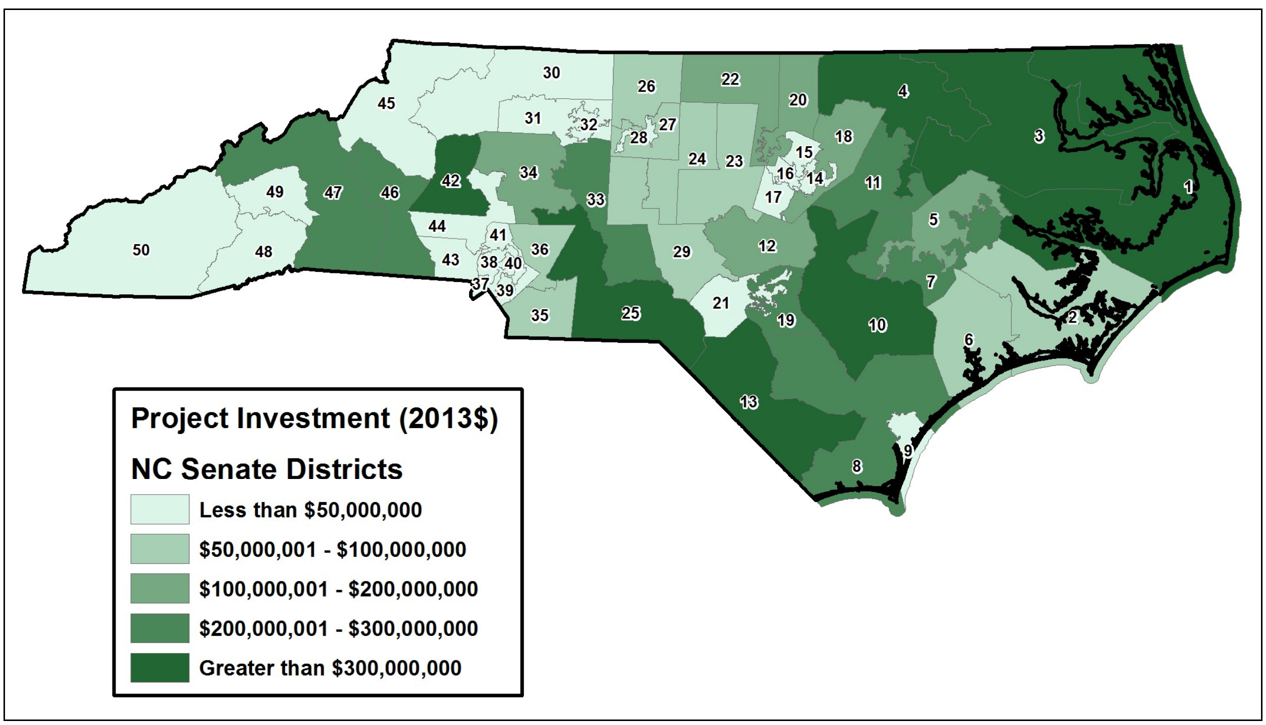

Table B-3. Major Investments in Renewable Energy Across North Carolina House Districts (Millions 2013$)

NC House District	Biomass	Hydro	Landfill Gas/ Fuel Cell	Solar Photovoltaic	Solar Thermal	Wind	Total
1	–	–	–	54.6	–	194.1	248.7
2	46.5	–	–	64.9	–	–	111.3
3	–	–	–	124.9	–	–	124.9
4	15.8	–	8.3	259.6	–	–	283.8
5	2.9	–	–	120.4	–	194.1	317.4
6	–	–	–	120.1	–	–	120.1
7	–	–	–	50.6	–	–	50.6
8	–	–	–	164.4	–	–	164.4
9	–	–	–	14.5	–	–	14.5
10	–	–	–	112.5	–	–	112.5
11	–	–	–	7.7	–	–	7.7
12	–	–	11.0	91.5	–	–	102.5
13	–	–	–	13.2	–	–	13.2
14	–	–	–	–	–	–	–
15	–	–	4.8	34.9	–	–	39.7
16	–	–	–	–	–	–	–
17	46.5	–	–	–	–	–	46.5
18	–	–	–	14.0	–	–	14.0
19	–	–	–	–	–	–	–
20	–	–	–	–	1.0	–	1.0
21	349.1	–	–	295.5	–	–	644.6
22	1.7	–	15.5	242.6	–	–	259.9
23	–	–	–	247.0	–	–	247.0
24	–	–	–	43.6	–	–	43.6
25	–	–	–	203.5	–	–	203.5
26	–	–	3.9	18.9	–	–	22.8
27	–	–	–	8.7	–	–	8.7
28	–	–	–	152.0	–	–	152.0
29	–	–	–	–	–	–	–
30	–	–	–	13.0	–	–	13.0
31	–	–	8.5	9.5	–	–	18.0
32	–	–	–	300.8	–	–	300.8
33	–	–	–	25.2	–	–	25.2
34	–	–	–	3.1	–	–	3.1
35	–	–	–	–	–	–	–
36	–	–	–	7.1	–	–	7.1
37	–	–	15.4	37.7	–	–	53.1
38	–	–	–	–	–	–	–

(continued)

Table B-3. Major Investments in Renewable Energy Across North Carolina House Districts (Millions 2013$) (continued)

NC House District	Biomass	Hydro	Landfill Gas/ Fuel Cell	Solar Photovoltaic	Solar Thermal	Wind	Total
39	–	–	–	20.6	–	–	20.6
40	–	–	–	3.1	–	–	3.1
41	–	–	–	–	–	–	–
42	–	–	–	–	–	–	–
43	–	–	–	25.5	–	–	25.5
44	–	–	–	–	–	–	–
45	–	2.6	–	249.5	–	–	252.2
46	–	–	–	172.8	–	–	172.8
47	115.0	–	2.5	266.9	–	–	384.4
48	–	–	–	252.1	–	–	252.1
49	–	–	–	3.0	–	–	3.0
50	–	–	–	73.6	1.4	–	75.0
51	–	–	–	67.2	–	–	67.2
52	–	–	–	74.0	–	–	74.0
53	–	–	–	82.3	–	–	82.3
54	–	13.5	–	37.2	–	–	50.7
55	–	–	–	97.3	–	–	97.3
56	–	–	–	–	–	–	–
57	–	–	–	5.0	–	–	5.0
58	–	–	–	–	1.2	–	1.2
59	–	–	–	50.9	–	–	50.9
60	–	–	–	–	–	–	–
61	–	–	–	2.1	–	–	2.1
62	–	–	–	9.6	–	–	9.6
63	–	–	–	22.6	–	–	22.6
64	–	–	–	60.1	–	–	60.1
65	2.3	–	–	90.7	–	–	93.0
66	–	–	–	316.1	–	–	316.1
67	–	–	23.1	96.2	–	–	119.4
68	–	–	–	13.2	–	–	13.2
69	–	–	–	–	–	–	–
70	–	–	–	4.1	–	–	4.1
71	–	–	–	–	–	–	–
72	–	–	6.1	–	2.2	–	8.3
73	–	–	–	42.6	–	–	42.6
74	–	–	–	4.2	–	–	4.2
75	–	–	–	14.9	–	–	14.9
76	1.3	–	–	35.7	–	–	37.0

(continued)

Table B-3. Major Investments in Renewable Energy Across North Carolina House Districts (Millions 2013$) (continued)

NC House District	Biomass	Hydro	Landfill Gas/ Fuel Cell	Solar Photovoltaic	Solar Thermal	Wind	Total
77	–	–	–	27.2	–	–	27.2
78	–	–	–	27.3	–	–	27.3
79	–	–	–	88.9	–	–	88.9
80	–	–	4.2	9.8	–	–	14.0
81	–	–	–	113.9	–	–	113.9
82	–	–	28.3	3.8	15.1	–	47.3
83	6.2	–	–	33.1	–	–	39.3
84	–	–	8.5	–	–	–	8.5
85	–	4.4	–	4.9	–	–	9.4
86	–	4.4	–	21.4	–	–	25.8
87	–	–	–	3.1	–	–	3.1
88	–	–	–	–	–	–	–
89	–	–	70.5	227.3	–	–	297.8
90	–	–	11.5	20.1	–	–	31.6
91	–	–	2.0	39.7	–	–	41.7
92	21.1	–	–	10.6	–	–	31.6
93	–	–	–	–	–	–	–
94	–	–	–	–	–	–	–
95	–	–	–	13.2	–	–	13.2
96	–	–	–	79.1	–	–	79.1
97	–	–	–	30.0	–	–	30.0
98	–	–	4.6	–	–	–	4.6
99	–	–	–	–	–	–	–
100	–	–	–	–	–	–	–
101	–	–	–	1.6	–	–	1.6
102	–	–	–	2.8	–	–	2.8
103	–	–	–	–	–	–	–
104	–	–	–	–	–	–	–
105	–	–	–	–	–	–	–
106	–	–	–	–	–	–	–
107	16.9	–	–	3.3	–	–	20.2
108	–	–	–	25.5	–	–	25.5
109	–	–	–	3.8	–	–	3.8
110	–	–	7.2	22.4	–	–	29.6
111	–	–	–	162.3	–	–	162.3
112	–	–	–	242.4	–	–	242.4
113	–	–	–	–	1.3	–	1.3
114	–	–	–	–	–	–	–

(continued)

Table B-3. Major Investments in Renewable Energy Across North Carolina House Districts (Millions 2013$) (continued)

NC House District	Biomass	Hydro	Landfill Gas/ Fuel Cell	Solar Photovoltaic	Solar Thermal	Wind	Total
115	–	–	3.6	–	–	–	3.6
116	–	–	–	23.2	–	–	23.2
117	–	–	–	12.6	1.4	–	14.0
118	–	–	–	10.1	–	–	10.1
119	–	–	–	–	–	–	–
120	–	–	–	19.7	–	–	19.7
Total	**625.2**	**25.0**	**239.5**	**6,332.6**	**23.6**	**388.2**	**7,634.2**

Figure B-2. NC House Districts Map

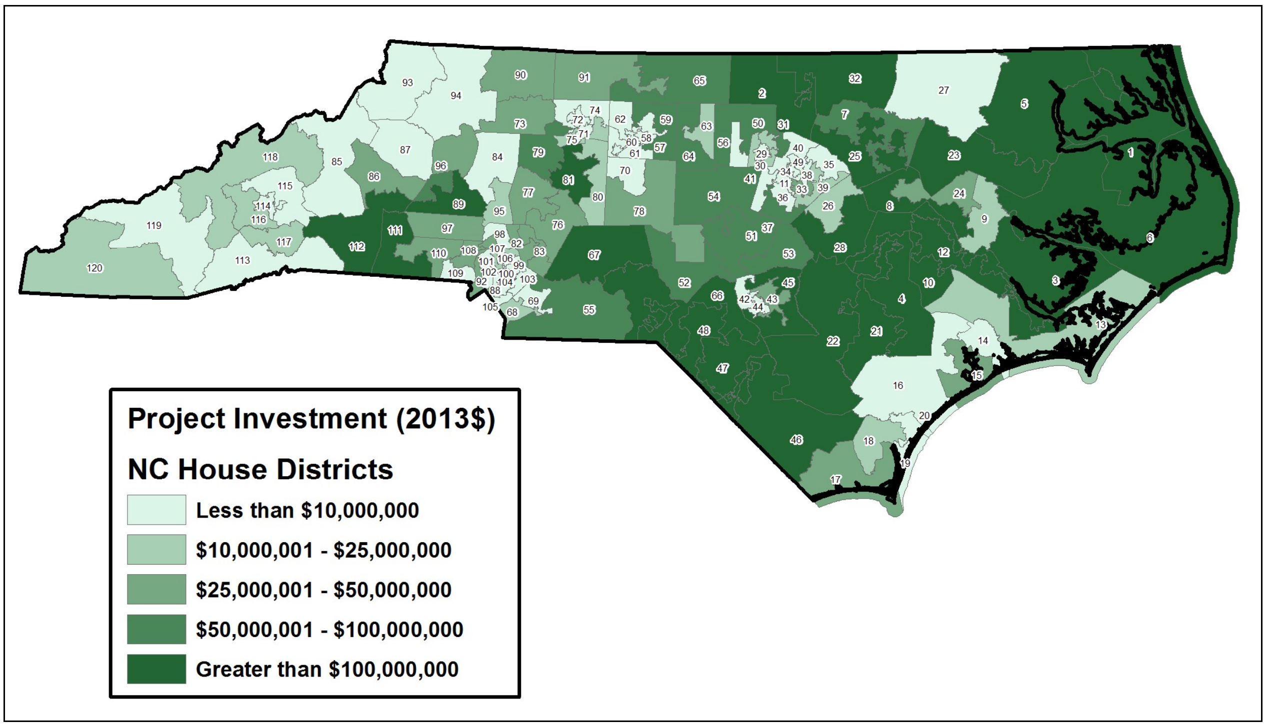

Figure B-3. U.S. Congressional House Districts Map