Chapter 1
Background and Overview

The Governor's Initiative

Creation of and Charge to the Climate, Energy, and Commerce Advisory Committee

On February 16, 2007, South Carolina Governor Mark Sanford issued Executive Order No. 2007-04 establishing the Governor's Climate, Energy, and Commerce Advisory Committee (CECAC) with the following charges:[1]

1. The CECAC shall consider the potential benefits, costs, savings, and feasibility of furthering building and infrastructure efficiency, and of carbon dioxide (CO_2) mitigation options and related energy policy and economic opportunities, and develop specific recommended actions.

2. The CECAC shall not exceed 30 members appointed by the Governor, including representatives from some or all of the following sectors: Tourism and Recreation, Agriculture and Forestry, Renewable Energy, Transportation, Insurance, Banking and Finance, Manufacturing, Electric Power Generation, Advanced Technology, Construction and Building, Small Business, Public Health, Conservation Organizations, State and Local Government, Educational Institutions, and the General Public.

3. The CECAC shall be authorized to hold public meetings and take such actions as it deems necessary and advisable to achieve its purpose.

4. The CECAC shall meet as needed and submit a Climate, Energy, and Commerce Action Plan to the Governor by July 2008.[2]

5. The CECAC may receive support from the Departments of Natural Resources and Health and Environmental Control in achieving its mission.

The Governor asked the Center for Climate Strategies (CCS) to work in partnership with his office and agencies of the state to provide facilitation and technical support for a process to complete the following tasks through joint activities of the CECAC, a set of Technical Work Groups (TWGs), state agencies, and members of the public. To develop an Action Plan as directed by the Governor's Executive Order, the CECAC was tasked with completion of the following specific planning recommendations:[3]

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[1] State of South Carolina, Executive Department, Office of the Governor, Executive Order No. 2007-04 (http://www.scgovernor.com/executive/orders/ex_orders_2007.htm).

[2] The South Carolina Governor's office issued an extension for completion of the CECAC's final recommendations from March to July 2008 to provide the CECAC with the time needed to fully complete its work.

[3] These planning recommendations are included in the CECAC Process Memo which provides a detailed work plan and description of the Action Plan process. The Process Memo is provided in Appendix B of this report.

1. Review and approval of a current and comprehensive inventory and forecast of greenhouse gas (GHG) emissions in South Carolina from 1990 to 2020;

2. Development and recommendation of a comprehensive set of specific policy recommendations and associated analyses to reduce GHG emissions and enhance energy and economic policy in South Carolina by 2020 and beyond;

3. Development and recommendation of a set of statewide GHG reduction goals and targets for implementation of these actions; and

4. Issuance of recommendations in the form of a final report to the Governor by July 2008.

CECAC's Response to Governor's Charge

In response to the Governor's charge, the CECAC has prepared this "Climate, Energy, and Commerce Action Plan," which documents the CECAC's recommendations and associated analyses to reduce GHG emissions and enhance energy and economic policy in South Carolina by 2020 and beyond. More than 90 South Carolinians who were members of the CECAC and the five TWGs that supported the CECAC held over 70 meetings to identify, analyze, deliberate, and ultimately recommend a comprehensive set of specific policies for South Carolina. The CECAC presents this report covering:

- An inventory of historical, current, and forecasted GHG emissions in South Carolina;
- A description and analysis of recent policies and programs that will reduce GHG emissions in South Carolina;
- GHG emission reduction goals for South Carolina and recommended policies to achieve these goals;
- Recommended mechanisms for implementing these goals and policies across all sectors of South Carolina's economy;
- Estimated GHG emission reductions from the recommended policies, expressed in metric tons of carbon dioxide equivalents (tCO_2e);
- Consideration of the costs or cost savings associated with the recommendations; and
- Challenges inherent in each recommendation, as well as feasibility issues.

Key recommendations and accomplishments of the CECAC are:

- Recommendation of a comprehensive set of 51 specific policies to reduce GHG emissions and address climate-, energy-, and commerce-related issues in South Carolina. The CECAC members present and voting approved 46 policy actions unanimously, and approved 5 by a super majority (four objections or fewer). Explanations of objections are in the appendixes to this report, which contain detailed accounts of the CECAC's recommendations.
- Recommendation of a voluntary, economy-wide goal for South Carolina to reduce gross GHG emissions to 5% below 1990 levels by 2020, equal to successful implementation of the policy recommendations. The state should (1) evaluate progress toward meeting the recommended goal at least once every 5 years and report the results of this evaluation to the

public, and (2) consider reviewing at least once every 5 years realistic GHG reduction goals for years beyond 2020. Of the 51 policy recommendations, 38 were analyzed quantitatively to have a cumulative effect of reducing emissions by about 55 million metric tons of carbon dioxide equivalent ($MMtCO_2e$) in 2020. Together, if the 38 quantified policy recommendations and the recent federal actions (or their equivalent) are successfully implemented, the 2020 GHG emission reduction goal would come very close to being achieved.

- Evaluation of the costs, savings, and feasibility of building and infrastructure efficiency to enhance energy and economic policy in South Carolina. The CECAC analyzed quantitatively the costs or cost savings of 33 of its 51 policy recommendations. Although the total net cost associated with the 33 policies analyzed is estimated at about $1.6 billion between now and 2020, the weighted-average cost-effectiveness of the 33 policies is estimated to be approximately $\$5/tCO_2e$ reduced. Many of the policies are estimated to yield significant cost-saving opportunities for South Carolinians. Other policies will incur net costs because they are targeting changes in current practices that require incentives, capital investment, or other cost outlays.
- Review, update, and approval of a comprehensive inventory and forecast of GHG emissions in South Carolina for 1990 through 2020. This is the first comprehensive, statewide GHG inventory and forecast that has been developed for South Carolina. It has benefited from the expertise of many CECAC and TWG members who provided state-specific data.

Recent Actions

GHG Reductions Associated With Recent Federal Actions

The federal Energy Independence and Security Act of 2007 was signed into law in December 2007. This law contains several requirements that will reduce GHG emissions as they are implemented over the next few years. During the CECAC process, sufficient information was identified (e.g., implementation schedules) to estimate GHG emission reductions associated with implementing the Corporate Average Fuel Economy (CAFE) requirements and energy efficiency requirements for new appliances and lighting in South Carolina. The GHG emission reductions projected to be achieved by these actions are shown in Figure 1-1. Table 1-1 provides the numeric estimates underlying Figure 1-1. Together these federal requirements are estimated to reduce emissions in South Carolina by about 5.7 $MMtCO_2e$ (a 4.5% reduction) from the business-as-usual emissions in 2020 for all sectors combined. Note, however, that GHG emission reductions associated with the Title IV (Energy Savings in Buildings and Industry) and Title V (Energy Savings in Government and Public Institutions) requirements of the federal Energy Independence and Security Act of 2007 have not been quantified because of the uncertainties in how they will be implemented. It is expected that the Title IV and Title V requirements will overlap with some of the RCI policy recommendations, especially RCI-5, RCI-6, RCI-7, and RCI-8.

Recent State Actions

South Carolina adopted several pieces of legislation in the 2007–2008 legislative session relevant to renewable energy, energy efficiency, and transportation. The following provides a brief summary of the legislation adopted. A detailed listing of the legislation has been complied by the

South Carolina Energy Office and is available at the following website: http://www.energy.sc.gov/index.aspx?m=1&t=67.

Renewable Energy

- H. 3649 enhances incentives for biomass energy development by removing legislative caps on tax credits for biomass energy equipment, biodiesel and ethanol production, and other alternative energy incentives. It also removes caps on incentive payments for alternative fuel retailers and biomass energy producers.
- S. 1143 allows South Carolina gas suppliers to continue to blend fuel with ethanol instead of buying a pre-blended version from national oil companies.
- H. 4766 requires the South Carolina Energy Office to report on agency progress towards goals and staff the Wind Energy Production Farms Feasibility Study Committee, which will release a report by January 2010.

Energy Efficiency

- The Energy Independence and Sustainable Construction Act of 2007 (H. 3034) requires application of "green building" or comparable standards to major facilities to be constructed on state property with 10,000 or more square feet.
- H. 3395 requires the South Carolina Energy Office and the Office of Regulatory Staff to recommend process and procedures for establishing net metering programs at all distribution electric utilities in the state.
- H. 4766 creates specific energy reduction and reporting requirements for state agencies by requiring state agencies to prepare Energy Conservation Plans in order to meet an energy consumption reduction goal of 20% by 2020, using 2000 as a baseline year. It also requires incandescent light bulbs used by a state agency to be replaced with compact fluorescent bulbs when the incandescent bulb needs replacing. Relating to purchase of energy conservation products by a state agency, the South Carolina Energy Office may certify for procurement only a product that meets or exceeds federal Energy Star standards.
- Beginning in 2009, S. 1141 creates a new sales tax rebate program for ENERGY STAR manufactured homes. It amends the state solar tax credit to include credits for small hydropower and energy efficient products worth up to 25% of the cost of the purchase and installation, with a maximum of $3,500 per year for up to 10 years.
- Beginning in 2009, S. 1143 provides a sales tax holiday for the entire month of October each year for purchase of Energy Star appliances and other Energy Star products costing $2,500 or less.
- Non-legislative efforts are also taking off. For example, a partnership of the South Carolina Energy Office, local homebuilder associations, and Southface Energy Institute is piloting an EarthCraft house program, through which over 200 EarthCraft homes have been built. These actions indicate growing momentum for improving energy efficiency and reducing GHG emissions in the state.

Transportation

- S. 368 requires South Carolina to give purchasing preference to hybrid, plug-in hybrid, biodiesel, hydrogen fuel cell and flex-fuel vehicles when the performance, quality and life cycle costs are comparable to other available motor vehicles.
- H. 3279 creates a study committee charged with reviewing all mass transit systems in South Carolina.
- H. 3853 prohibits commercial diesel vehicles from idling more than ten minutes in any 60-minute period.

Figure 1-1. Estimated emission reductions associated with the effect of recent federal actions in South Carolina (consumption-basis, gross emissions)

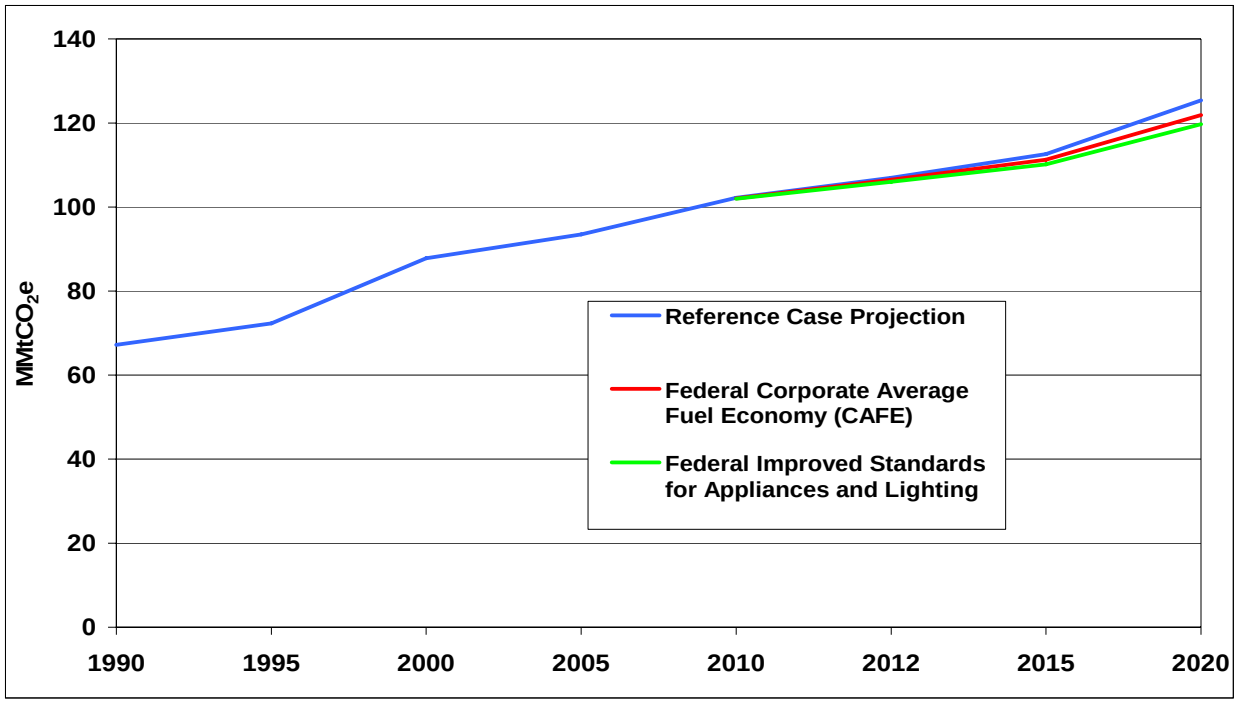

Table 1-1. Estimated emission reductions associated with the effect of recent federal actions in South Carolina (consumption-basis, gross emissions)

Sector / Recent Action	GHG Reductions ($MMtCO_2e$)		GHG Emissions ($MMtCO_2e$)	
			Business as Usual	With Recent Actions
	2012	2020	2020	2020
Residential, Commercial and Industrial (RCI)				
Energy Efficiency Requirements for New Appliances and Lighting	0.50	2.19	19.88	17.69
Transportation and Land Use (TLU)				
Corporate Average Fuel Economy (CAFE) Requirements	0.45	3.51	43.57	40.06
Total (RCI + TLU Sectors)	**0.96**	**5.70**	**63.45**	**57.75**
Total (All Sectors)			**125.4**	**119.7**

GHG = greenhouse gas; MMtCO2e = million metric tons of carbon dioxide equivalent.

The CECAC Process

The CECAC first met on April 27, 2007, and met a total of nine times, with the final decisional meeting held on May 9, 2008, and then a conference call for review of this report. The CECAC also held via conference call an information session on cap-and-trade and carbon tax mechanisms. In all, more than 70 meetings and teleconference calls of the CECAC and the five supporting TWGs were held to identify and analyze various potential policy actions in advance of the CECAC's May 9, 2008, final decisional meeting.

The five TWGs considered information and potential recommendations in the following sectors:

- Residential, Commercial, and Industrial (RCI);
- Energy Supply (ES);
- Transportation and Land Use (TLU);
- Agriculture, Forestry, and Waste Management (AFW); and
- Cross-Cutting Issues (CC) (i.e., issues that cut across the above sectors).

CCS provided facilitation and technical assistance to the CECAC and each of the TWGs. The TWGs consisted of CECAC members as well as individuals who were not on the CECAC but who did have an interest in and expertise regarding the issues being addressed by each TWG (see Appendix C for a listing of the members of each TWG). The TWGs served as advisers to the CECAC and helped generate initial recommendations on priority policy recommendations for analysis. They then developed draft proposals on the design characteristics and quantification of the proposed policy recommendations. Where members of a TWG did not fully agree on recommendations to the CECAC, the summary of their efforts was reported to the CECAC for further consideration and actions. The CECAC then made its decisions after reviewing the TWGs' proposals.

The CECAC process involved a model of informed self-determination through a facilitated, stepwise, consensus-building approach. With oversight by the South Carolina Governor's Office, the process was conducted by CCS, an independent, expert facilitation and technical analysis team. It was based on procedures that CCS consultants have used in a number of other state climate change planning initiatives since 2000, but was adapted specifically for South Carolina. The CECAC process sought but did not mandate consensus, and it explicitly documented the level of CECAC support for some policies and key findings established through a voting process established in advance.

The 51 policy recommendations (out of more than 250 potential options considered) adopted by the CECAC and presented in this report underwent two levels of screening by the CECAC. First, a potential policy recommendation being considered by a TWG was not accepted as a "priority for analysis" and fleshed out for full analysis unless it had a super majority of support from CECAC members present at the decisional meetings (with "super majority" defined as four objections or fewer by CECAC members attending a meeting). Second, after the analyses were conducted, only policy recommendations that received at least majority support (defined as less

than half of those present objecting) from CECAC members present at the decisional meetings were adopted by the CECAC and included in this report. The TWGs' recommendations to the CECAC were documented and presented to the CECAC at each CECAC meeting. All of the CECAC and TWG meetings were open to the public, and all materials for and summaries of the CECAC and TWG meetings were posted on the CECAC Web site (www.scclimatechange.us).

Analysis of Policy Recommendations

With CCS providing facilitation and technical analysis, the five TWGs submitted recommendations for policies for CECAC consideration using a "policy option template" conveying the following key information:

Policy Description
Policy Design (Goals, Timing, Parties Involved)
Implementation Mechanisms
Related Policies/Programs in Place
Type(s) of GHG Reductions
Estimated GHG Reductions and Net Costs or Cost Savings
Key Uncertainties
Additional Benefits and Costs
Feasibility Issues
Status of Group Approval
Level of Group Support
Barriers to Consensus

In its deliberations, the CECAC modified and embraced various policy recommendations. The final versions for each sector, conforming to the policy option templates, appear in Appendixes F through J and constitute the most detailed record of decisions of the CECAC. Appendix E describes the methods used for quantification of the 38 policy recommendations that were analyzed quantitatively. The quantitative analysis produced estimates of the GHG emission reductions and costs (or cost savings) of various policies, both in terms of a net present value from 2008 to 2020 and a dollars-per-ton cost (i.e., cost-effectiveness).[4] The key methods are summarized below.

Estimates of GHG Reductions: Using the projection of future GHG emissions (see below) as a starting point, 38 policy recommendations were analyzed by CCS to estimate GHG reductions attributable to each policy in the individual years of 2012 and 2020 and cumulative reductions over the period 2008–2020. The estimates were prepared in accordance with guidance by the appropriate TWG and the CECAC, which later reviewed the estimates and, in some cases, directed that they be revised with respect to such elements as goals, data sources, and methodology. Many policies were estimated to affect the quantity or type of fossil fuel combusted; others affected methane or CO_2 sequestered. Among the many assumptions involved

[4] The analysis addressed emission reductions and associated costs or cost savings and did not attempt to estimate specific price changes or utility rate changes that might result from implementation of a policy recommendation. There was no attempt to monetize the benefit of emission reductions in atmospheric concentration (e.g., health benefits).

in this task was selection of the appropriate GHG accounting framework—namely, the choice between taking a "production-based" approach versus a "consumption-based" approach to various sectors of the economy.[5] The CECAC took a "production-based" approach in all sectors except the electricity sector, in both forecasting emissions and in estimating the GHG impacts of policies. This issue, along with other GHG estimation issues (e.g., analysis of overlapping or interacting policy impacts), is discussed in detail in Appendix E (Methods for Quantification).

Estimates of Costs/Cost Savings: The analyses of 33 policy recommendations included estimates of the cost of those policies, both in terms of net costs or cost savings during 2008–2020 and a dollars-per-ton cost (i.e., cost-effectiveness).[6] (The other 5 policy recommendations that were analyzed with respect to their GHG reductions were such that their costs or cost savings could not be readily estimated.) The following provides a brief summary of the approach used to estimate costs or cost savings associated with the policy recommendations:

- *Discounted and annualized costs or cost savings*—Fairly standard approaches were taken here. The net present value of costs or cost savings was calculated by applying a real discount rate of 5%. Dollars-per-ton estimates were derived as an annualized cost per ton, dividing the present value cost or savings by the cumulative GHG reduction measured in tons. As was the case with GHG reductions, the period 2008–2020 was analyzed.
- *Cost savings*—Many policies created easily monetized cost savings (e.g., fuel savings and electricity savings). In these cases, monetized cost savings were subtracted from monetized costs, resulting in net costs. These net costs could be positive or negative; negative costs indicated that the policy saved money or produced "cost savings."
- Direct vs. indirect effects—Estimates of costs and cost savings were based on "direct effects" (i.e., those borne by the entities implementing the policy).7 Implementing entities could be individuals, companies, and/or government agencies. In contrast, conventional cost-benefit analysis takes the "societal perspective" and tallies every conceivable impact on every entity in society (and quantifies these wherever possible).

Contributing Issues: The CECAC recommendations were guided in part by the GHG reductions and monetized costs and cost savings of various policies, but members also felt that other considerations (e.g., social, economic, and environmental) should also have weight. The TWGs were asked to examine these qualitative terms where deemed important and quantify

[5] A production-based approach estimates GHG emissions associated with goods and services produced within the state, and a consumption-based approach estimates GHG emissions associated with goods and services consumed within the state. In some sectors of the economy, these two approaches may not result in significantly different numbers. However, the power sector is notable in that it is responsible for large quantities of GHG emissions, and states often produce more or less electricity than they consume (with the remainder attributable to power exports or imports). South Carolina is an example of a state that is a net exporter of electric power.

[6] The analysis addressed the costs or cost savings of each policy recommendation and, with the exception of a few recommendations that address rate structures, did not attempt to estimate specific price changes or utility rate changes that might result from implementation of a policy.

[7] "Additional benefits and costs" were defined as those borne by entities other than those implementing the policy recommendation. These indirect effects were quantified on a case-by-case basis, depending on magnitude, importance, need, and availability of data.

them on a case-by-case basis, as needed, depending on need and where data were readily available. In some cases, the recommended actions are precise, concrete steps. In other cases, they are more general, and work must be done to develop precise, concrete steps to achieve the goals recommended by the CECAC. In the latter case, precise, concrete actions need to be identified before the recommended policies can be implemented.

South Carolina GHG Emissions Inventory and Reference Case Projections

In June 2007, CCS prepared a draft GHG emissions inventory and reference case projection for the CECAC to assist the CECAC and TWGs in understanding past, current, and possible future GHG emissions in South Carolina, and thereby inform the policy development process.[8] The CECAC and TWGs reviewed, discussed, and evaluated the draft inventory and projections methodologies as well as alternative data and approaches for improving the draft inventory and projections. The inventory and reference case projections were revised to address the comments approved by the CECAC and were subsequently approved by the CECAC at its ninth meeting.[9]

The inventory and reference case projections included detailed coverage of all economic sectors and GHGs in South Carolina, including future emission trends and assessment issues related to energy, economic, and population growth. The assessment included estimates of total statewide "gross emissions" (leaving aside carbon sequestration[10]) on a production basis for all sources and on a consumption basis for the electricity sector (see prior discussion under "Analysis of Policy Recommendations" in this chapter for an explanation of the production versus consumption approach). Further discussion of the issues involved in developing the inventory and reference case projections is summarized in Chapter 2 (Inventory and Projections of GHG Emissions) and discussed in detail in the final report for the inventory and reference case projections.

The inventory and reference case projections revealed substantial emissions growth rates and related mitigation challenges. Figure 1-2 shows the reference case projections for South Carolina's gross GHG emissions as rising fairly steeply to 125 $MMtCO_2e$ by 2020, growing by 87% over 1990 levels. Figure 1-2 also provides the sectoral breakdown of projected GHG emissions.

The inventory and reference case projections of South Carolina's GHG emissions provided the following critical findings:

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[8] Center for Climate Strategies. Draft South Carolina Greenhouse Gas Inventory and Reference Case Projections, 1990–2020. Prepared for the Climate, Energy, and Commerce Advisory Committee of the Office of the Governor of South Carolina. June 2007.

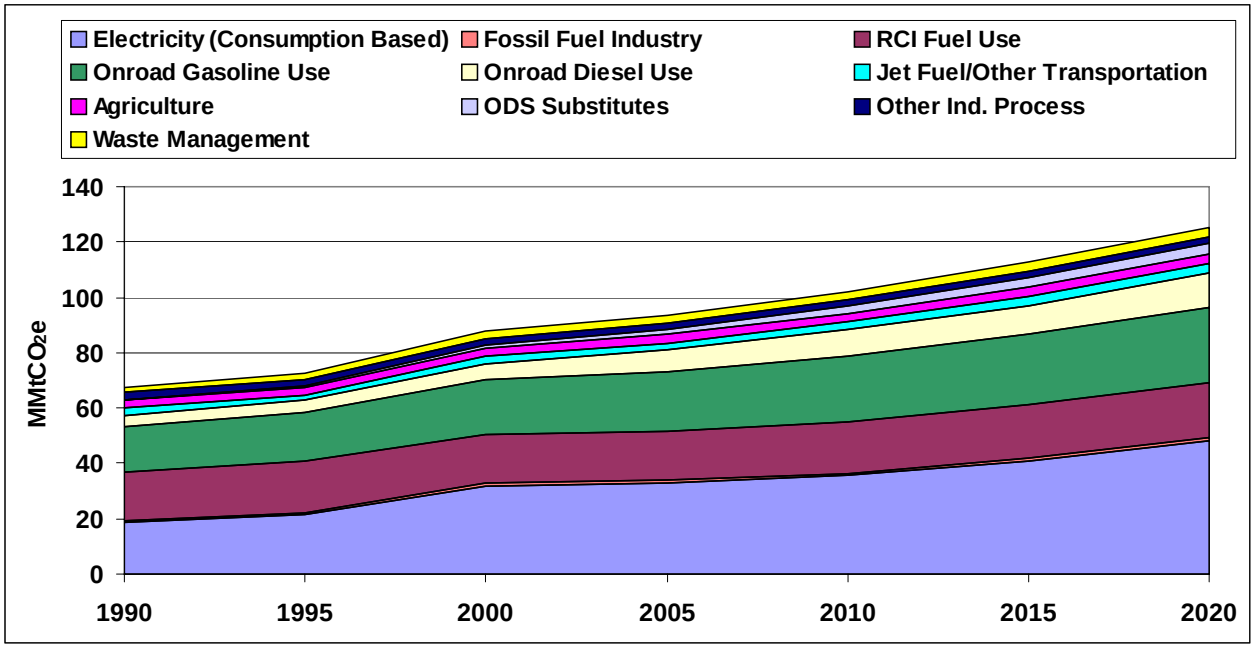
[9] Center for Climate Strategies. Final South Carolina Greenhouse Gas Inventory and Reference Case Projections, 1990–2020. Prepared for the Climate, Energy, and Commerce Advisory Committee of the Office of the Governor of South Carolina. June 2008 (http://www.scclimatechange.us/Inventory_Forecast_Report.cfm).

[10] Sequestration refers to the storing of carbon in mines, brine strata, oceans, plants and soil. As trees and other plants grow they remove CO_2, the principal GHG, from the atmosphere transforming the carbon (C) through photosynthesis into cellulose, starch and sugars, thus sequestering it in their structures and roots. The oxygen (O_2) is released back into the atmosphere. South Carolina's forests and agricultural lands are capable of sequestering much CO_2, as described in Chapter 7 (Agriculture, Forestry, and Waste Management).

- As is common in many states, the production and consumption of electricity and transportation are the sectors with the largest emissions, and they are expected to continue to grow faster than other sectors.
- From 2005 to 2020, emissions associated with electricity generation to meet both in-state and out-of-state demand are projected to be the largest contributor to future emissions growth, followed by emissions associated with the transportation sector. Other sources of emissions growth include the RCI fuel use sectors, the transmission and distribution of natural gas, and the increasing use of hydrofluorocarbons and perfluorocarbons as substitutes for ozone-depleting substances in refrigeration, air conditioning, and other applications.

While South Carolina's estimated emissions growth rate, presents challenges, it also provides major opportunities. Key choices regarding technologies and infrastructure can have a significant impact on the emissions of a fast-growing state. The CECAC's recommendations document the opportunities for the state to reduce its GHG emissions while continuing its strong economic growth by being more energy efficient; using more renewable energy sources; increasing the use of cleaner transportation modes, technologies, and fuels; and encouraged the use of more nuclear energy.

Figure 1-2. Gross GHG emissions by sector, 1990–2020: historical and projected (consumption-based approach) business-as-usual/base case



RCI = direct fuel use in residential, commercial, and industrial sectors; ODS = ozone-depleting substance; Ind. = industrial.

CECAC Policy Recommendations (Beyond Recent Actions)

The CECAC recommended 51 policy actions. The CECAC members present and voting approved 46 policy actions unanimously, and approved 5 by a super majority (four objections or

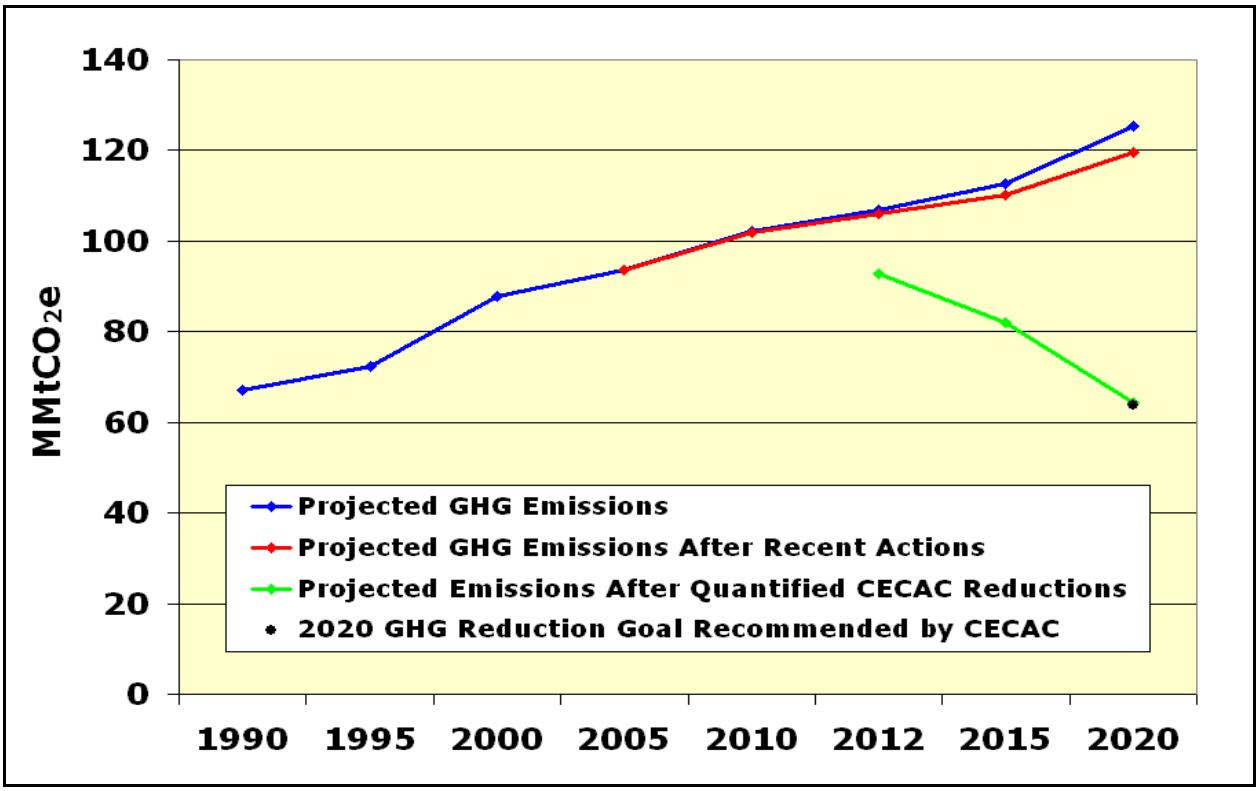
fewer). Explanations of objections are in the appendixes to this report, which contain detailed accounts of the CECAC's recommendations.

A total of 38 of the 51 policy recommendations were analyzed quantitatively to estimate their effects on emissions. Of these 38 analyzed, 33 were analyzed quantitatively to estimate their costs or cost savings. The 38 recommendations for which emission reductions were quantified were estimated to have a cumulative effect of reducing emissions by about 55 $MMtCO_2e$ in 2020.

Figure 1-3 presents a graphical summary of the potential cumulative emission reductions associated with the recent federal actions and the 38 policy recommendations relative to the business-as-usual reference case projections. Table 1-2 provides the numeric estimates underlying Figure 1-3. In Figure 1-3,

- The blue line shows actual (for 1990, 2000, and 2005) and projected (for 2010, 2012, 2015, and 2020) levels of South Carolina's gross GHG emissions on a consumption basis. (The consumption-based approach accounts for emissions associated with the generation of electricity in-state to meet South Carolina's demand for electricity, and excludes emissions associated with the generation of electricity in-state that is exported to other states, since these emissions would be included in the accounts of the other states.)
- The red line shows projected emissions associated with recent federal actions that were analyzed quantitatively.
- The green line shows projected emissions if all of the CECAC's 38 recommendations that were analyzed quantitatively with respect to their GHG reduction potential are implemented successfully and the estimated reductions are fully achieved. (Note that other CECAC recommendations would have the effect of reducing emissions, but those reductions were not analyzed quantitatively, so are not reflected in the green line.)
- The black dot shows the projected emission level associated with the CECAC's recommendation of a voluntary, economy-wide goal for South Carolina to reduce its GHG emissions economy-wide by 5% below 1990 emissions by 2020. Together, if the 38 quantified policy recommendations and the recent federal actions (or their equivalent) are successfully implemented, the 2020 GHG emission reduction goal would come very close to being achieved based on results of analysis of CECAC proposals conducted through the CECAC and TWG process. CECAC's economic evaluation of the policy options was guided by an overall approach limited to estimation of the direct cost or savings of implementation on a statewide level (see Appendix E, CCS Quantification Memo for more detail). The CECAC did not break those costs or savings down to the individual, household, or organization levels for each option, and has not fully evaluated the costs or benefits of each policy from a broader macroeconomic, social or environmental standpoint. Further evaluation of both the broader impacts of the policy recommendations and the breakdown of costs and benefits should be considered prior to adoption by the state.

Figure 1-3. Annual GHG emissions: reference case projections and CECAC recommendations (consumption-basis, gross emissions)



$MMtCO_2e$ = million metric tons of carbon dioxide equivalent; GHG = greenhouse gas; CECAC = Climate, Energy, and Commerce Advisory Committee.

Table 1-2. Annual emissions: reference case projections and impact of CECAC recommendations (consumption-basis, gross emissions)

Annual Emissions ($MMtCO_2e$)	1990	2000	2005	2010	2012	2015	2020
Projected GHG Emissions	67.2	87.8	93.5	102.2	106.9	112.6	125.4
Reductions From Recent Actions*			0.0	0.3	1.0	2.4	5.7
Projected GHG Emissions After Recent Actions			93.5	102.0	106.0	110.1	119.7
Total GHG Reductions From 38 Analyzed CECAC Recommendations					13.2	29.0	55.4
Projected Annual Emissions After Quantified CECAC Reductions†					92.8	82.1	64.3
2020 GHG Reduction Goal Recommended by CECAC							63.9

$MMtCO_2e$ = million metric tons of carbon dioxide equivalent; GHG = greenhouse gas; CECAC = Climate, Energy, and Commerce Advisory Committee.

* Reductions from recent actions include the Energy Independence and Security Act of 2007, Title III. Refer to Annex 1 to Appendix G for more information. GHG reductions from Titles IV and V of this Act have not been quantified because of the uncertainties in how they will be implemented. It is expected that Titles IV and V measures will overlap with RCI policies, especially RCI-5, RCI-6, RCI-7, and RCI-8.

† Projected annual emissions also include reductions from recent actions.

The 33 recommendations analyzed in terms of their costs or cost savings were estimated to have a total net cost of about $1.6 billion between now and 2020; however, the weighted-average cost-effectiveness of the 33 policies is estimated to be approximately $5/t$CO_2$e reduced. While the emission reductions and costs or cost savings of the CECAC's 13 other policy recommendations were not readily quantifiable, some of them would most likely achieve additional reductions at a net savings (e.g., recommendations for the TLU sector). In addition, emerging technologies may hold the potential to reduce emissions even further.

Table 1-3 provides a summary by sector of the estimated cumulative impacts if all of the CECAC's recommendations are successfully implemented. Table 1-4 shows the estimated GHG reductions, the costs or savings from each policy recommendation, and each policy's cost-effectiveness (cost or savings per ton of reduction) upon which the cumulative impacts in Table 1-3 are based. Note that the cumulative impacts shown in Table 1-3 account for overlaps between policies by eliminating potential double counting of emission reductions and costs or cost savings. Chapters 3 through 7 and the appendixes provide detailed descriptions and analyses of GHG reductions, costs or cost savings, additional impacts, feasibility, etc., for each policy developed by the CECAC for each sector.

For the policies recommended by the CECAC to yield the levels of estimated emission reductions shown in Table 1-3, they must be implemented in a timely, aggressive, and thorough manner. In some cases, the recommended actions are precise, concrete steps. In other cases, they are more general, and work must be done to develop precise, concrete steps to achieve the goals recommended by the CECAC. In the latter case, precise, concrete actions need to be identified before the recommended policies can be implemented. Careful, comprehensive, and detailed planning and implementation, as well as consistent support, of these policies will be required if benefits to consumers and the environment are to be achieved.

Table 1-3. Summary by sector of estimated impacts of implementing all of the CECAC recommendations (cumulative reductions and costs/savings)

Sector	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)
	2012	2020	Total 2008–2020		
Residential, Commercial, and Industrial	4.3	27.7	141.6	–$2,941	–$21
Energy Supply	0.3	3.0	22.5	$1,012	$45
Transportation and Land Use	0.8	5.5	29.3	$2,582	$88
Agriculture, Forestry, and Waste Management	7.8	19.2	135.0	$987	$7.3
Cross-Cutting Issues	Non-quantified, enabling options				
TOTAL (includes all adjustments for overlaps)	**13.2**	**55.4**	**328.4**	**$1,640**	**$5.0**

GHG = greenhouse gas; MMtCO2e = million metric tons of carbon dioxide equivalent; $/tCO2e = dollars per metric ton of carbon dioxide equivalent.

Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the policy recommendations.

Within each sector, values have been adjusted to eliminate double counting for policies or elements of policies that overlap. In addition, values associated with policies or elements of policies within a sector that overlap with policies or elements of policies in another sector have been adjusted to eliminate double counting. Appendix E of this report provides documentation of how sector-level emission reductions and costs (or cost savings) were adjusted to eliminate double counting associated with overlaps between policies.

Table 1-4. Residential, Commercial, and Industrial Policy Recommendations

No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)			Net Present Value 2009–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2012	2020	Total 2009–2020			
RCI-1	Energy Efficiency Programs, Funds, or Goals for Electricity (Residential, Commercial, and Industrial)	1.5	8.2	43.0	–$1,127	–$26	Unanimous
RCI-2	Demand-Side Management/Energy Efficiency Programs, Funds, or Goals for Natural Gas, Propane, and Fuel Oil	0.2	0.8	4.5	–$379	–$85	Unanimous
RCI-3	Incentives and Regulatory Reform To Promote Implementation of Renewable Energy Systems, Including Solar Hot Water (Residential, Commercial, and Industrial)*	0.2	0.6	4.0	$164	$41	Unanimous
RCI-4	Energy Management Training/Training of Building Operators	Not quantified					Unanimous
RCI-5	Incentives, Resources, and Regulatory Reform To Promote Energy Recycling, Including Combined Heat and Power	1.0	8.2	39.5	–$332	–$8	Unanimous
RCI-6	Incentives and Policies for Improving Building Efficiency, Including Building Energy Codes	1.6	7.2	40.4	–$665	–$16	Unanimous
RCI-7	Improved Design and Construction in New and Existing State and Local Government Buildings, "Government Lead by Example"	0.5	5.0	24.6	–$800	–$33	Unanimous
RCI-8	Participation in Voluntary Industry–Government Partnerships (Including Incentives)	0.0	0.0	0.05	Not quantified*		Unanimous
RCI-9	Incentives and Policies for Improving Appliance Efficiency, Including Appliance Standards	0.3	0.9	5.6	–$94	–$17	Unanimous
	Sector Total After Adjusting for Overlaps (excluding RCI-8)†	**4.3**	**27.7**	**141.6**	**–$2,941**	**–$21**	
	Reductions From Recent Actions††	**0.5**	**2.2**	**12.6**	**Not quantified**		
	Sector Total Plus Recent Actions	**4.9**	**29.9**	**154.2**	**–$2,941**	**–$21**	

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent.

All costs are reported in 2005 U.S. dollars, net present value as of January 1, 2009. Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the recommendations. Totals in some columns may not add to the totals shown due to rounding.

The numbering used to denote the above policy recommendations is for reference purposes only; it does not reflect prioritization among these policy recommendations.

*The costs of RCI-8 have not been quantified, due to lack of publicly available data. For more information, refer to the discussion of Key Uncertainties under RCI-8 in Appendix G of this report.

† The benefits and costs of RCI policies overlap as follows: between residential and commercial new construction in RCI-1 and RCI–6; between residential and commercial new construction in RCI-2 and RCI–6; between RCI–7 and energy efficiency efforts in government and schools within RCI-1 and RCI-2; and between RCI-9 and parts of RCI-1, RCI-2, and RCI-7. Overlaps also occur between RCI-1 and the energy efficiency component of ES-1, and between

the electricity load reductions from RCI policies in general and ES-1; adjustments for these overlaps are made in the ES totals. The benefits and costs of renewable energy in RCI-7 overlap with ES renewable energy policies and are not included.

†† Reductions from recent actions include the Energy Independence and Security Act of 2007, Title III. Refer to Annex 1 to Appendix G for more information. GHG reductions from Titles IV and V of this Act have not been quantified because of the uncertainties in how they will be implemented. It is expected that Titles IV and V measures will overlap with RCI policies, especially RCI-5, RCI-6, RCI-7, and RCI-8.

Table 1-4 (continued). Energy Supply Policy Recommendations

No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2012	2020	Total 2008–2020			
ES-1	Efficiency and Renewable Portfolio Standard and Statement of Support for Nuclear Energy	1.9	12.6	66.5	$689	$10	Super Majority (Three objections)
ES-1a	Energy Efficiency: 5% of energy met with energy efficiency resources by 2020	0.8	4.2	22.4	–$586	–$26	
ES-1b	Renewables: 5% of energy served by new renewable resources by 2020	1.1	3.8	25.3	489	$19	
ES-1c	Nuclear: 6% of energy served by new nuclear resources by 2020	0.0	4.6	18.9	$786	$42	
ES-2	Technology Research and Development, Including State Funding	Not quantified					Unanimous
ES-3	Renewable Energy Financing, Tax Incentives, Loans	0.4	0.9	7.1	$591	$84	Unanimous
ES-4	Regulatory Model To Equalize Utility Earnings on Energy Efficiency With Earnings on Traditional Power Supply	Not quantified					Super Majority (One objection)
ES-5	Nuclear Fuel Reprocessing	Not quantified					Unanimous
ES-6	Green Power Purchases and Marketing, 1% Participation by 2012	0.2	0.2	1.7	$46	$27	Unanimous
ES-7	Attract Renewable Energy Technology Businesses to South Carolina	Not quantified					Unanimous
ES-8	Distributed Renewable Energy Incentives and/or Barrier Removal (Including Interconnection Rules)	0.05	0.1	0.8	$42	$50	Unanimous
	Sector Total After Adjusting for Overlaps	**0.3**	**3.0**	**22.5**	**$1,201**	**$53**	
	Reductions From Recent Actions	**0.0**	**0.0**	**0.0**	**0**	**0**	
	Sector Total Plus Recent Actions	**0.3**	**3.0**	**22.5**	**$1,201**	**$53**	

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent.

All costs are reported in 2005 U.S. dollars, net present value as of January 1, 2009. Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the recommendations. Totals in some columns may not add to the totals shown due to rounding.

The numbering used to denote the above policy recommendations is for reference purposes only; it does not reflect prioritization among these policy recommendations.

General definition: For the purposes of the policies discussed here, and unless otherwise noted, “renewable energy” is defined as follows: A renewable energy resource includes solar; wind; small hydroelectric; geothermal; ocean current or wave energy; biomass resources, including agricultural waste, animal waste, wood waste, spent pulping liquors, combustible residues, combustible liquids, combustible gases, energy crops, and landfill methane; waste heat derived from a renewable energy resource and used to produce electricity; and hydrogen derived from a renewable energy resource.

For the combined impact of all ES policy recommendations, the incentives for utility-scale renewable energy projects in ES-3 are assumed to be redundant with the renewable energy mandate in ES-1; however, the distributed energy incentives in ES-3 are found to be larger than the impact of ES-8, and ES-8 is found to have no incremental impact over ES-3. These distributed renewable energy incentives, as well as voluntary green power initiatives (ES-6) are assumed to be incremental, and not to overlap with ES-1. Further, the energy efficiency component of ES-1 is assumed to overlap with the energy efficiency policy under RCI-1, and the goals for the nuclear and renewables components of ES-1 are reduced to reflect energy savings under RCI-1.

Several ES sector policy recommendations rely on biomass feedstock to replace fossil-based electricity generation. Similarly, a number of AFW policies also rely on the use of biomass for both electricity production and other energy-related uses. Specifically, the biomass generation benefits in ES policies 1, 3, and 6 are found to overlap with AFW policies 2, 5, and 9. The fundamental limit that creates an overlap among these policies is the limited availability of biomass feedstock in South Carolina.

To accommodate this limit, the cumulative impact analysis for the ES sector does not include any of the electricity generation from woody biomass, swine waste, or poultry litter resulting from ES policies, and the impact of landfill gas generation has been reduced by 18%. Either this generation is already accounted for in AFW policies, or the feedstock is used for another purpose that has a similar or greater impact in mitigating GHG emissions in the state.

Table 1-4 (continued). Transportation and Land Use Policy Recommendations

No.	Policy Recommendation		GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
			2012	2020	Total 2008–2020			
TLU-1	Adopt a South Carolina Clean Car Standard		0.21	1.14	7.04	–$323 to $1,598	–$46 to $227	Super Majority (Two objections)
TLU-2	Transportation System Management		0.01	0.04	0.22	< $0	< $0	Unanimous
TLU-3	Tax Credits for Efficient Vehicles		0.02	0.12	0.68	$244	$359	Unanimous
TLU-4	Improve Development Patterns		0.41	2.31	14.02	< $0	< $0	Unanimous
TLU-5	Transit & Bike-Pedestrian [Incorporates TLU-11]		0.02	0.02	0.22	–$1	–$1	Unanimous
TLU-6	Alternative-Fuel Infrastructure		0.02	0.24	0.77	$54	$70	Unanimous
TLU-7	Diesel Engine Emission Reductions and Fuel Efficiency Improvements	Efficiency Improvements	0.03	0.19	0.96	–$110	–$114	Unanimous
		Biodiesel	0.05	0.38	1.95	–$291 to $319	–$15 to $164	Super Majority (Two objections)
TLU-8	Stricter Enforcement of Speed Limits		0.10	0.12	1.18	Not quantified	Not quantified	Unanimous
TLU-9	Make Full Use of CMAQ Funds		Not quantified					Unanimous
TLU-10	Commuter Choice and Commuter Benefits Programs		0.12	0.43	2.63	–$631	–$240	Unanimous
TLU-12*	Low-GHG Fuel Standard		0.38	3.67	17.89	$20 to $3,276	$1 to $183	Super Majority (Two objections)
TLU-14	Rail		Not quantified					Unanimous
	Sector Total Before Adjusting for Overlaps		**1.37**	**8.64**	**47.57**	**Not quantified**		
	Sector Total After Adjusting for Overlaps†		**0.75**	**5.53**	**29.29**	**$2,582**	**$88**	
	Reductions From Recent Actions		**0.45**	**3.51**	**16.37**	**Not quantified**		
	Sector Total Plus Recent Actions		**1.20**	**9.04**	**45.66**	**$2,582**	**$88**	

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent; CMAQ = Congestion Mitigation and Air Quality.

All costs are reported in 2005 U.S. dollars, net present value as of January 1, 2009. Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the recommendations. Totals in some columns may not add to the totals shown due to rounding.

The numbering used to denote the above policy recommendations is for reference purposes only; it does not reflect prioritization among these policy recommendations.

* TLU-12 overlaps with AFW-4. The individual totals for TLU-12 do not reflect this overlap.

† Accounts for overlap between TLU-12 and AFW-4.

Table 1-4 (continued). Agriculture, Forestry, and Waste Management Policy Recommendations

No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO2e)	Level of Support
		2012	2020	Total 2008–2020			
AFW-1*	On-Farm Energy Efficiency	0.052	0.16	1.0	–$43	–$41	Unanimous
AFW-2a	On-Farm Waste Energy Recovery—Swine/Dairy	0.006	0.019	0.13	$0.58	$5	Unanimous
AFW-2b†	On-Farm Waste Energy Recovery—Poultry Litter	0.010	0.031	0.20	–$3.2	–$16	Unanimous
AFW-3	Expanded Use of Local Agricultural Products	0.012	0.030	0.21	Not quantified	Not quantified	Unanimous
AFW-4a†,‡	In-State Liquid Biofuels Production—Biodiesel	0.12	0.13	1.5	$26	$17	Unanimous
AFW-4b†	In-State Liquid Biofuels Production—Ethanol	0.86	1.5	13	$281	$22	Unanimous
AFW-5‖	Expanded Use of Biomass Feedstocks for Electricity, Heat, or Steam Production	2.7	4.9	41	$156	$4	Unanimous
AFW-6a	Terrestrial Carbon Sequestration—Agriculture	0.21	0.39	3.1	–$191	–$62	Unanimous
AFW-6bi	Terrestrial Carbon Sequestration—Forestry: Forest Management	0.33	0.85	5.8	$53	$9	Unanimous
AFW-6bii	Terrestrial Carbon Sequestration—Forestry: Afforestation/Reforestation	0.81	2.4	16	$158	$10	Unanimous
AFW-6biii¶	Terrestrial Carbon Sequestration—Forestry: Urban Forestry	0.37	1.2	7.5	$456	$60	Unanimous
AFW-7a	Conservation and Restoration of Agriculture Lands for Enhanced Carbon Sequestration	0.080	0.21	1.5	$54	$37	Unanimous
AFW-7b	Conservation and Restoration of Forestlands for Enhanced Carbon Sequestration	0.42	3.1	16	$117	$7	Unanimous
AFW-8	Advanced Recycling and Composting	1.18	3.0	20	–$44	–$2	Unanimous
AFW-9‖	Waste-to-Energy Reclamation	0.41	1.0	7.2	$0.23	$0.03	Unanimous
AFW-10*	Water and Wastewater Energy Efficiency Improvements	0.16	0.18	1.6	–$33	–$21	Unanimous
	Sector Total After Adjusting for Overlaps**	**7.8**	**19.2**	**135**	**$987**	**$7**	
	Reductions From Recent Actions	**—**	**—**	**—**	**—**	**—**	
	Sector Total Plus Recent Actions**	**7.8**	**19.2**	**135**	**$987**	**$7**	

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent.

All costs are reported in 2005 U.S. dollars, net present value as of January 1, 2009. Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the recommendations. Totals in some columns may not add to the totals shown due to rounding.

The numbering used to denote the above policy recommendations is for reference purposes only; it does not reflect prioritization among these policy recommendations.

* AFW-1 and AFW-10 may overlap with RCI-6. However, for reasons stated in the documentation of AFW-1 and AFW-10, no overlap is counted.

† AFW-4 overlaps with TLU-12 (Transportation and Land Use). This overlap is accounted for in the cumulative analysis of the TLU options.

‡ AFW-4 biodiesel targets were unachievable with in-state feedstock supplies. These reductions and costs refer to modified goals based on in-state feedstock. See text under AFW-4 in Appendix J of this report.

|| AFW-2, AFW-5, and AFW-9 overlap with ES-1. These overlaps are accounted for in the cumulative analysis of the ES policy recommendations.

¶ AFW-6biii represents the combined costs and benefits of two elements of urban forestry: tree planting and avoided deforestation. The net cost of avoided deforestation was not quantified because of insufficient information regarding the costs of such programs.

** Totals may not equal sum of rows because of independent rounding. The cost-effectiveness totals represent the total net present value divided by the cumulative (2008–2020) GHG reductions for those options for which quantitative cost analyses were performed (i.e., excludes AFW-3).

Table 1-4 (continued) Cross-Cutting Issues Policy Recommendations

No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effective-ness ($/tCO_2e$)	Level of Support
		2012	2020	Total 2008–2020			
CC-1	Inventories and Forecasting	Not quantified					Unanimous
CC-2	GHG Reporting and Registry	Not quantified					Unanimous
CC-3	State Government GHG Emissions (Lead by Example)	Not quantified					Unanimous
CC-4	Comprehensive Local Government Climate Action Plans (Counties, Cities, etc.)	Not quantified					Unanimous
CC-5	Public Education and Outreach	Not quantified					Unanimous
CC-6	Adaptation & Vulnerability	Not quantified					Unanimous
	Sector Total After Adjusting for Overlaps	**Not quantified**					
	Reductions From Recent Actions	**Not quantified**					
	Sector Total Plus Recent Actions	**Not quantified**					

GHG = greenhouse gas; MMtCO2e = million metric tons of carbon dioxide equivalent; $/tCO2e = dollars per metric ton of carbon dioxide equivalent.

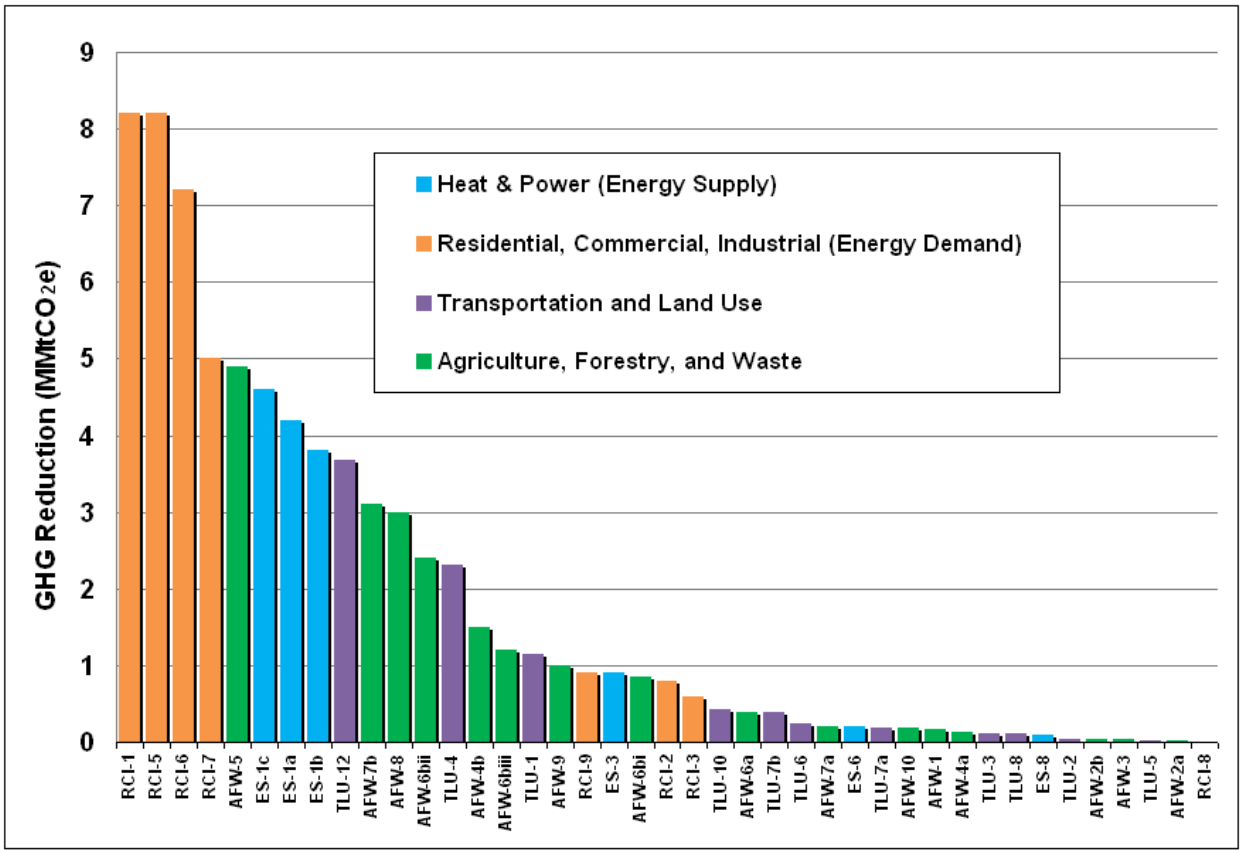
The numbering used to denote the above policy recommendations is for reference purposes only; it does not reflect prioritization among these policy recommendations.

Perspectives on Policy Recommendations

As explained above, the CECAC considered the estimates of the GHG reductions that could be achieved by 38 of its recommendations, and the costs (or cost savings) of 33 of those 38. Figure 1-4 presents the estimated tons of reductions for each policy recommendation for which

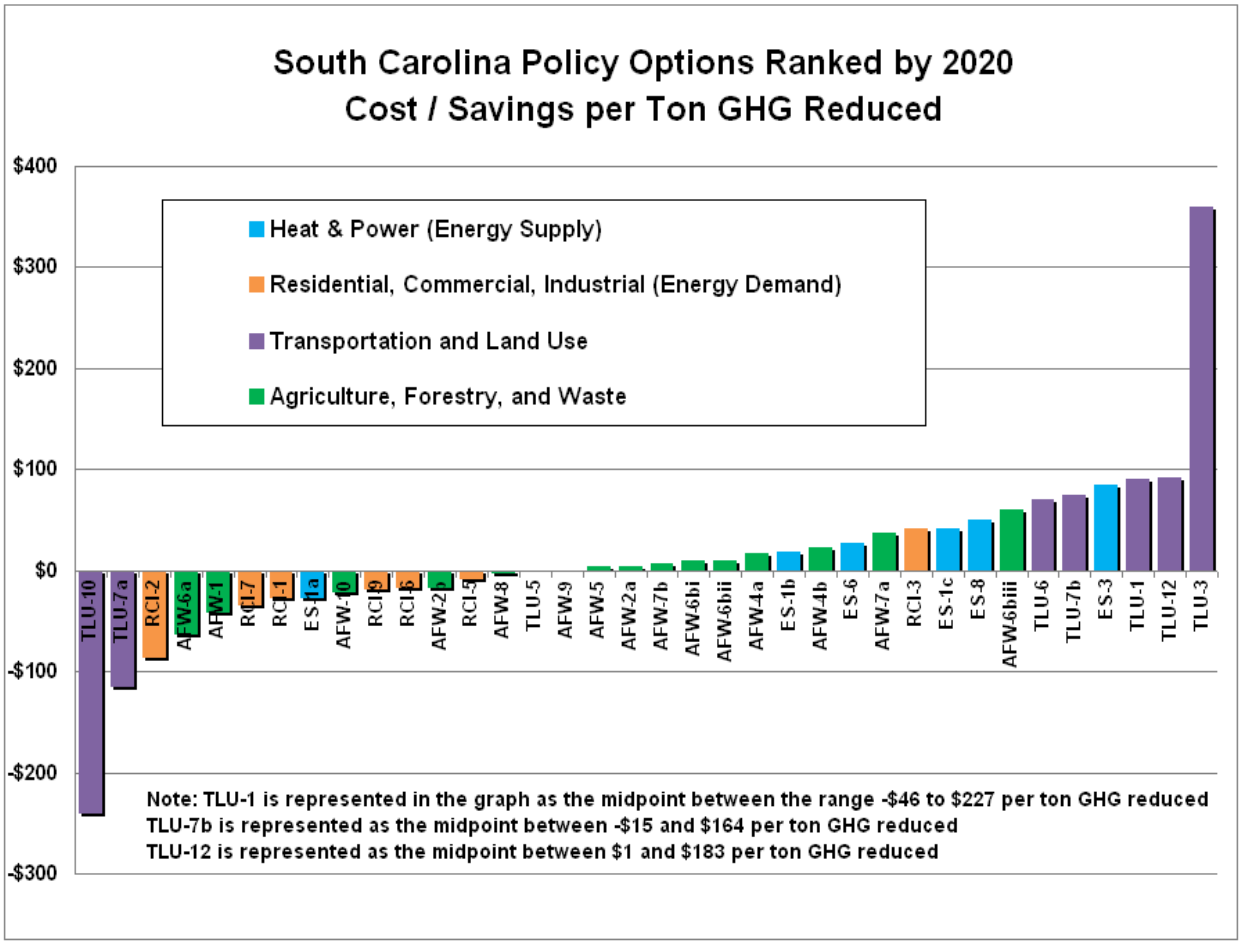
estimates were quantified, expressed as a cumulative figure for the period 2008–2020. In addition to the imprecision in GHG reductions achieved by each policy recommendation, there are also uncertainties in the exact cost (or cost savings) per ton of reduction achieved. Figure 1-5 presents the estimated dollars-per-ton cost (or cost savings, depicted as a negative number) for each policy recommendation for which cost estimates were quantified. This measure is calculated by dividing the net present value of the cost of the policy recommendation by the cumulative GHG reductions, all for the period 2008–2020. There can be considerable variations in the estimates of GHG emission reductions as well as the exact cost (or cost savings) per ton of reduction associated with the range of policy recommendations. Having the emissions reduction and cost-effectiveness values was helpful, but the CECAC was mindful that these are estimates. CECAC members noted that even though the quantification of impacts associated with the policies were developed using the best information that could be identified during the CECAC process, the results may be uncertain and subject to change as better information becomes available in the future. While individual members of the CECAC may not endorse each and every quantification method or data input, the members of the CECAC acknowledge the quantification analyses as helpful in evaluating the GHG reductions and implementation costs or savings that may be expected from the various recommendations contained in this report.

Figure 1-4. CECAC policy recommendations ranked by 2020 annual GHG reduction potential



GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; RCI = Residential, Commercial, and Industrial; TLU = Transportation and Land Use; ES = Energy Supply.

Figure 1-5. CECAC policy recommendations ranked by cost/cost savings per ton of GHG removed



GHG = greenhouse gas; RCI = Residential, Commercial, and Industrial; TLU = Transportation and Land Use; ES = Energy Supply; AFW = Agriculture, Forestry, and Waste Management.

Negative values represent net cost savings and positive values represent net costs associated with the policy recommendation.