

Chapter 3

Residential, Commercial, and Industrial Sectors

Overview of Greenhouse Gas Emissions

The residential, commercial, and industrial (RCI) sectors are directly responsible for almost one-fifth of North Carolina's current gross greenhouse gas (GHG) emissions (37 million metric tons (MMt) of carbon dioxide equivalent (CO₂e) in 2005). Direct emissions of GHGs from the RCI sectors result principally from the on-site combustion of natural gas, oil, and coal plus non-energy sources of GHG emissions – primarily leaks of methane from natural gas transmission and distribution pipelines, the release of CO₂ and fluorinated gases (PFCs) during industrial processing (largely from the aluminum production, soda ash consumption, and semi-conductor industries), the use of sulfur hexafluoride (SF₆) in the utility industry, and the leakage of hydrofluorocarbons (HFCs) from refrigeration and related equipment.¹

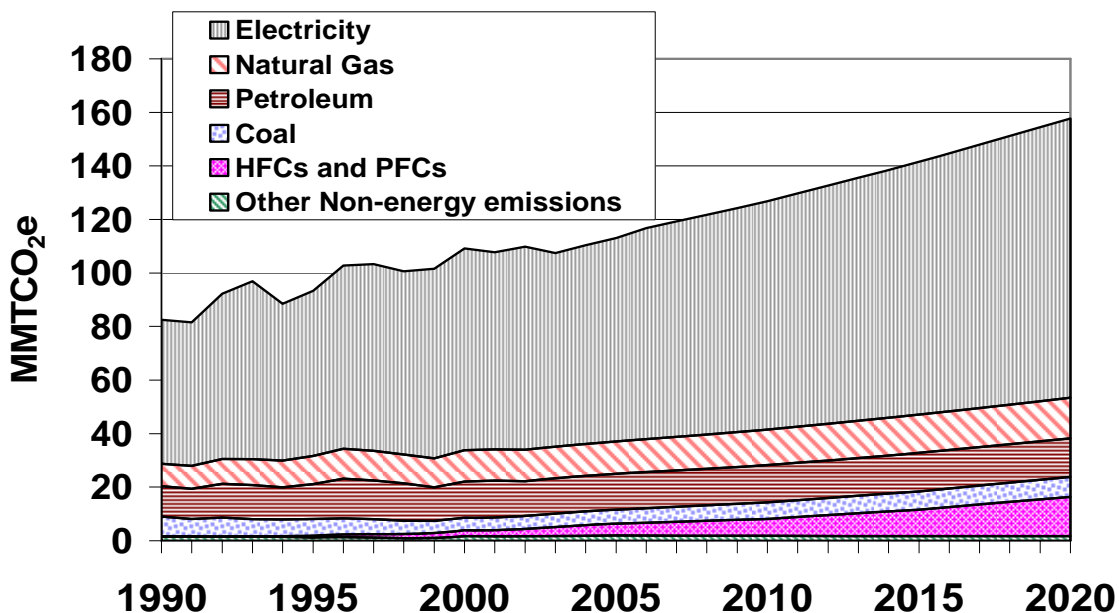
Considering only the direct emissions that occur within buildings and industries, however, ignores the fact that virtually all electricity sold in North Carolina is consumed as the result of activities in the residential, commercial, and industrial sectors. If the emissions associated with producing the electricity consumed in North Carolina are considered, RCI activities are associated with well over half (about 60% of the state's gross GHG emissions.² The State's future GHG emissions therefore will depend heavily on future trends in the consumption of electricity and other fuels in the RCI sectors.

Figure 3-1 shows historical and projected RCI GHG emissions by fuel and source, and illustrates the large fraction of RCI emissions associated with electricity use. RCI emissions associated with electricity and natural gas use are expected to rise by nearly 30% between 2005 and 2020, and are projected to account for over 40% of the State's growth in gross GHG emissions during this period.

¹ RCI direct fuel use accounted for 31.8 MMtCO₂e in GHG emissions in 2005, while industrial process emissions accounted for emissions totaling 5.4 MMtCO₂e.

² Gross emissions here denote greenhouse gas emissions from activities in North Carolina, adjusted for exports of electricity, but not including consideration of estimated "sinks" of greenhouse gases in the forestry and land-use sectors.

Figure 3-1. Historical and projected RCI GHG emissions by fuel and process in North Carolina, 1990 to 2020



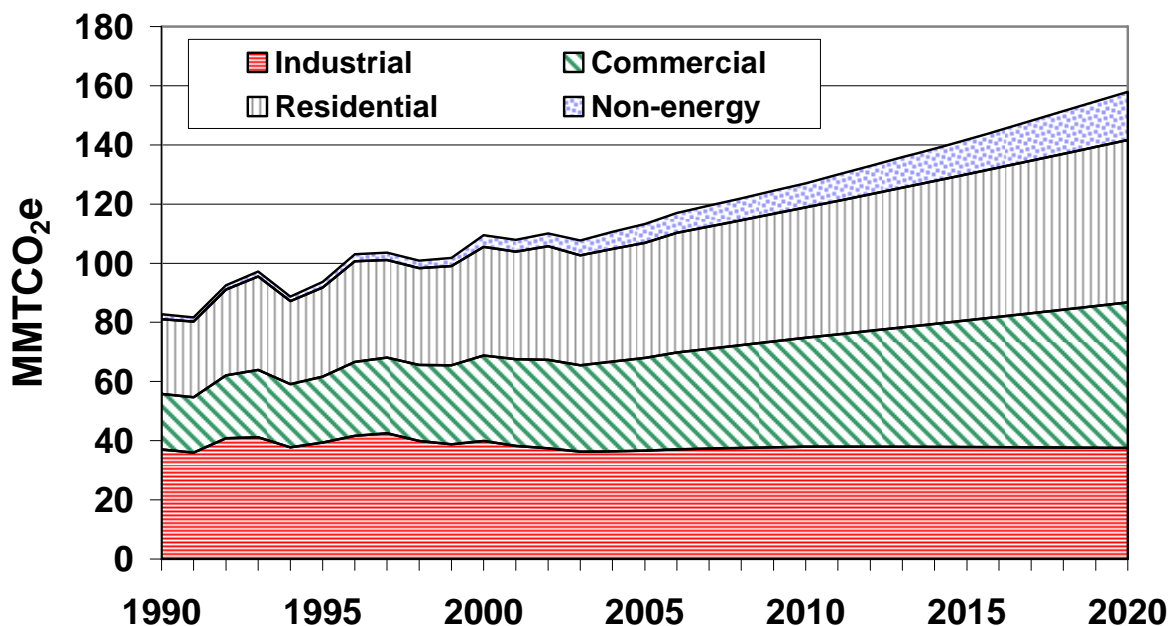
PFCs = perfluorocarbons; HFCs = hydrofluorocarbons.

Since 1990, overall GHG emissions associated with energy consumption in the residential and commercial sectors have grown steadily. This growth is projected to continue, driven by both population growth and increasing commercial activity (as indicated in Figure 3-2). The total emissions from electricity and fuels consumption in the industrial sector have varied, showing increases or and decreases year-to-year, in the years since 1990, but show only a very slight overall reduction from 1990 to 2005.³ The GHG emissions from industrial sector electricity and fuels use are expected to grow modestly through 2010, and decline slightly thereafter, so that 2020 emissions are projected to be about 2.5% higher than emissions in 2005. Non-energy emissions grew by a factor of more than 3 between 1990 and 2005, largely as a result of increased emissions from HFC use. This trend in non-energy emissions is expected to accelerate in the future. Non-energy emissions are projected to increase by over 8% per year from 2005 to 2020 – increasing from 2% of total gross GHG emissions in 2000 to almost 6% in 2020. Increased use of HFCs for refrigeration, air conditioning and other uses, as substitutes for ozone depleting substances, are the main source of the projected emissions increases. Even low amounts of HFCs, from leaks and other releases under normal use of the products, can lead to high GHG emissions in CO₂-equivalent terms, due to the high global warming potential of these

³ This reduction was largely the result of changes in North Carolina industrial activity and processes, rather than direct emissions reduction efforts. GHGs have not historically been considered pollutants or regulated in the same way that “criteria pollutants” (local and regional air pollutants such as oxides of sulfur and nitrogen) or hazardous air pollutants, and no post-combustion control/removal devices are commonly in use for CO₂, the major GHG species.

substances.⁴ Figure 3-2 shows the estimated contribution of the individual sectors to RCI emissions over time.

Figure 3-2. 1990–2020 GHG emissions by sector and source



Key Challenges and Opportunities

The principal means to reduce RCI emissions in North Carolina include improving energy efficiency, substituting for electricity and natural gas with lower-emission energy resources (such as wind, solar water heating, photovoltaics, and biomass), reducing industrial-sector process (non-energy) emissions, increasing distributed (consumer-sited) electricity generation based on renewable fuels and on combined heat and power, and various strategies to decrease the emissions associated with electricity production (see Chapter 5, Energy Supply, for the latter). The state’s limited implementation of energy efficiency programs and related initiatives in past years, relative to some other states that have aggressively pursued efficiency programs, provides a challenge—in rapidly assembling capacity to harvest energy efficiency resources—but also strong opportunities to reduce emissions through programs and initiatives to improve the efficiency of buildings, appliances, and industrial practices. An excellent start to building such programs and initiatives has been provided by the efforts of the State Energy Office (see, for example, the listing of Energy Office and other ongoing programs in NC provided in Annex A to the RCI Options Descriptions provided as Appendix E, by the recent Duke Energy and Progress

⁴ Projections of energy consumption in the RCI sectors are based on *NC Energy Outlook 2003*. Prepared by Global Insight for the State Energy Office, North Carolina Department of Administration, May 2003. Projections for emissions from HFC use are Growth rates are based on growth in projected national emissions from U.S. Department of State, *U.S. Climate Action Report 2002*, Washington, DC, May 2002. See [http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BNQ76/\\$File/ch5.pdf](http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BNQ76/$File/ch5.pdf)

Energy announcements that they will significantly expand their energy efficiency programs, by the recent passage of Senate Bill 3,⁵ and by programs outlined in the State Energy Plan (see below). At the same time, North Carolina's robust population and economic growth, and the North Carolina's leaders' growing commitment to carry out significant emissions reductions, places pressure on communities and businesses in North Carolina to make swift decisions to put in motion changes that will reduce emissions. A key challenge lies in the design and implementation of strategies that address State goals and thus ensure that new buildings and industries take full advantage of opportunities to reduce energy use and emissions.

Though overall investment in energy efficiency to date has been limited relative to that in a number of other states, there are a number of existing programs in North Carolina that can readily be built upon to reduce greenhouse gas emissions. These include a number of programs and initiatives through the North Carolina State Energy Office (to be expanded by recent legislation), including programs related to energy efficiency, training and certification of energy sector professionals, and others. Local organizations have provided building and industrial energy technical assistance (energy audits) for many years, and the North Carolina Greenpower program, offering consumers electricity generated from renewable sources, is ongoing. A systems benefit charge-funded program for energy efficiency and other services has likewise been operating in the State for many years, and several utilities have programs addressing energy efficiency through provision of low-interest loans and direct incentives. The State Energy Plan, first updated and published in 2003 and revised in 2005 (further updates are currently underway), identifies a strong list of initiatives to increase energy efficiency in the RCI sectors and in other areas of the North Carolina economy.⁶ While an indication of the growing efforts for improving efficiency and reducing emissions in North Carolina, these programs need to be further supported and extended to realize the overall potential of the state to slow its growth of energy use and emissions of GHG pollutants.

Overview of Mitigation Recommendations and Estimated Impacts

The CAPAG recommends a set of 11 mitigation options for the residential, commercial, and industrial sectors (including industrial process emissions from sources other than energy use) that offer the potential for major economic benefits and emissions savings. As summarized in Figure 3-3, these mitigation options, if fully implemented, could lead to emissions savings from reference case projections of 33 MMtCO_{2e} per year by 2020, and cumulative savings of 219 MMtCO_{2e} from 2007 through 2020.⁷ The mitigation options recommended could result in net

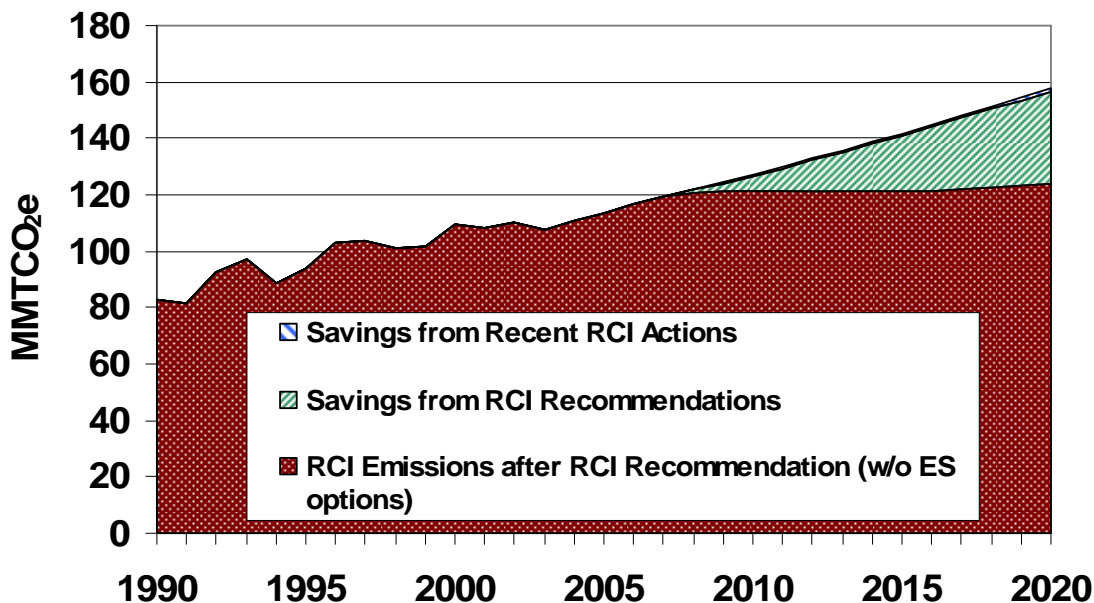
⁵ See, for example, <http://www.ncleg.net/Sessions/2007/Bills/Senate/HTML/S3v6.html>. Senate Bill 3, among other provisions, includes "Renewable Energy and Energy Efficiency Standards (REPS) for Electric Public Utilities." This bill passed in August 2007 and has been signed into law.

⁶ See *North Carolina State Energy Plan*, prepared for the North Carolina Energy Policy Council by the State Energy Office, North Carolina Department of Administration and Appalachian State University Energy Center (Revised edition January 2005), available at <http://www.energync.net/epc/docs/Energy%20Plan%202005.pdf>

⁷ Note that these figures do not include additional emission savings from recent actions that were not already accounted for in the reference case projections. See the Appendix E for more detailed information on these options, including details of how costs and savings of the options were calculated. Of the total 219 MMtCO_{2e} in cumulative emissions savings from the RCI policies, 211 MMtCO_{2e} are from reduced electricity consumption, 8 MMtCO_{2e} are from the reduction in on-site use of fossil fuels, though the latter total does not include avoided heating fuel savings from implementation of combined heat and power systems.

cost savings of nearly \$4.0 billion through the year 2020 on a net present value basis (NPV).⁸ Most emissions savings from the RCI options are in the form of reduced carbon dioxide emissions, with relatively minor reductions of emissions of other greenhouse gases (principally methane and nitrous oxide) produced via leakage and/or combustion of fuels.

Figure 3-3. Impact of CAPAG mitigation option recommendations on RCI emissions



The estimated impacts of the RCI mitigation options recommended by the CAPAG are shown in Table 3-1.⁹ Also shown in Table 3-1 are the results of several ongoing initiatives in North Carolina. These “Savings from Recent RCI Actions” are not accounted for in the reference inventory and forecast, but contribute to overall emissions reduction along with savings from the CAPAG-recommended measures. The combination of savings from recent actions and CAPAG mitigation options are, in the RCI sectors, estimated to be approximately the same as the projected reference case growth in emissions from 2007 through 2020, as shown by the trend in the dark area in Figure 3-3.

The CAPAG mitigation option recommendations described briefly here, and in more detail in Appendix E, result not only in significant emissions and costs savings, but offer a host of additional benefits as well. These benefits include – but are by no means limited to – potential investments in other areas of the economy as a result of reduced spending on energy by homeowners and businesses, contributions to local economic development, job growth, and

⁸ The net cost savings are calculated based on options costs that include fuel expenditures, operations, maintenance, and administrative costs, plus amortized, incremental equipment (capital) costs, less the costs of fuels and electricity that are saved as a result of implementation of RCI options. All NPV values described have been calculated using a 5% annual real discount rate.

⁹ Note that “UC” in the right hand “Level of Support” column of Table 3-1 indicates that the option was recommended by the CAPAG by unanimous consent of the CAPAG members present at the meeting where the option was reviewed.

enhancement of productivity, reduced local air pollution and related reduced impacts of air pollution on human health, reduction in the needs for and costs of electricity transmission and distribution system additions, and improvements in comfort, convenience, and indoor air quality as a result of building improvement measures.

In order for the RCI mitigation options recommended by the CAPAG to yield the levels of savings described here, the options must be implemented in a timely, aggressive, and thorough manner. This means, for example, not only putting the options themselves in place, but attending at the same time to the development of “supporting options” that are needed to help make the recommended options effective. Many of these supporting mitigation options are a part of the package of RCI options, while others are included among the mitigation options recommended as “cross-cutting” options (see Chapter 7), and/or in options recommended in other chapters of this report (most notably, in the case of RCI, in the Energy Supply Chapter). Improved building energy codes (RCI-6) will not be optimally effective, for example, without further support and intensified training of contractors, builders, architects, financial institutions, and building inspectors, among others, in the methods and benefits of efficient building design, and of building code enforcement (as recommended, in part, in RCI-8). Given that the way that energy-efficiency improvements made as buildings are constructed will save energy over the entire, often long, lifetime of those buildings, modest investments now in building codes, training for building sector professionals, and code enforcement will yield significant cost, energy, and GHG emissions savings for decades. Regulatory changes that provide incentives and lower disincentives for the adoption of consumer-sited combined heat and power and renewable electricity generation are also among the supporting initiatives crucial to the success of the RCI options recommended by the CAPAG; some of these options are already in the formative stages in North Carolina. The CAPAG’s work indicates that there are considerable benefits to both the environment and to consumers from adoption of the mitigation options recommended, but careful, comprehensive, and detailed planning and implementation, as well as consistent support (building on existing North Carolina programs and capacity whenever possible), of these options, and the initiatives and activities that they include, will be required if these benefits are to be achieved.

Table 3-1. CAPAG-recommended GHG emissions mitigation options and results for the RCI sectors

Option No.	Mitigation Option Name	GHG Reductions (MMtCO ₂ e)			Net Present Value 2007–2020 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2010	2020	Total 2007–2020			
Residential, Commercial, and Industrial							
RCI-1	Demand Side Management Programs for the Residential, Commercial and Industrial Sectors	1.9	11.6	77.1	–1,895	–25	UC
RCI-2	Expand Energy Efficiency Funds	1.5	8.0	54.8	–1,346	–25	UC
RCI-3	Energy Efficiency Requirements for Government Buildings	0.0	1.1	6.4	–88	–14	UC
RCI-4	Market Transformation and Technology Development Programs	0.0	2.0	10.5	–339	–32	UC
RCI-5	Improved Appliance and Equipment Efficiency Standards	0.0	1.0	5.3	–336	–63	UC
RCI-6	Building Energy Codes	0.5	3.5	23.1	–400	–17	UC
RCI-7	“Beyond Code” Building Design Incentives and Targets, Incorporating Local Building Materials and Advanced Construction	0.7	5.2	34.2	–494	–14	UC
RCI-8	Education (Consumer, Primary/Secondary, Post-Secondary/ Specialist, College and University Programs)	<i>Not quantified</i>					UC
RCI-9	Green Power Purchasing (required for state facilities) and Bulk Purchasing Programs for Energy Efficiency or Other Equipment	0.1	0.5	3.5	11	3	UC
RCI-10	Distributed Renewable and Clean Fossil Fuel Power Generation	1.2	4.6	33.5	392	12	UC
RCI-11	Residential, Commercial, and Industrial Energy and Emissions Technical Assistance and Recommended Measure Implementation	0.5	2.1	14.9	–494	–33	UC
Sector Total, after adjusting for overlaps		5.3	33.0	218.7	–3,994	–18	N/A
Reductions From Recent Actions (see table below)*		0.5	1.2	10.1			
Sector Total Plus Recent Actions		5.8	34.2	228.8			N/A

Emissions reductions associated with recent actions (and not included in reference case projections) that are related to RCI mitigation options

Option No.	Mitigation Option	Estimated 2010 GHG Reduction (MMtCO₂e)	Estimated 2020 GHG Reduction (MMtCO₂e)	Cumulative 2007–2020 GHG Reduction (MMtCO₂e)
RCI-1	Demand Side Management Programs for the Residential, Commercial and Industrial Sectors	0.3	0.7	6.2
RCI-2	Expand Energy Efficiency Funds	0.2	0.4	3.6
RCI-6	Building Energy Codes	0.0	0.0	0.0
RCI-9	Green Power Purchasing (required for state facilities) and Bulk Purchasing Programs for Energy Efficiency or Other Equipment	0.0	0.0	0.3

UC = unanimous consent; N/A = not applicable.

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

* “Recent actions” represent initiatives undertaken in North Carolina that reduce GHG emissions that were implemented shortly before or during the CAPAG process. The emission reductions associated with recent actions are not accounted for in the GHG emissions inventory and reference case projections. Emissions reductions associated with these recent actions were therefore estimated separately, and are counted toward overall statewide reductions along with reductions from the mitigation options recommended by the CAPAG.

Residential, Commercial, Industrial (RCI) Mitigation Option Descriptions

The Residential, Commercial, Industrial Sectors include emissions reduction opportunities related to improving energy (and sometimes water) use efficiency, using lower-GHG energy sources, and increasing consumer-sited renewable electricity generation and use of combined heat (and/or cooling) and power (CHP) systems. Additional detail on each of the options summarized below can be found in Appendix E.

RCI-1 Demand-Side Management Programs for the Residential, Commercial, and Industrial Sectors

The CAPAG recommends that Demand-side Management (DSM) programs funded by gas and electric utilities in North Carolina be expanded to yield higher levels of energy savings, demand response, and greenhouse gas emissions savings. Utility-funded DSM programs reduce either the consumption of or the demand for conventional sources of electricity and fossil fuels. Examples of DSM programs include technical assistance for and implementation of energy efficiency and renewable energy measures, electrical (and in some cases fuel) demand responses, alternative rate schedules, and research activities. The goal for this option is to reach a level of DSM investment in North Carolina equal to 1.5% of utility revenues by 2012. This option is designed to work in tandem with other strategies recommended by the CAPAG, including options described in other Chapters in this Report, which can also encourage efficiency gains.

Specific recommendations from the RCI TWG include proposing that the North Carolina General Assembly and the North Carolina Utilities Commission take an active role in encouraging the investor-owned, cooperative and municipal utilities to pursue active DSM programs.

Examples of utility-funded programs that this option supports include:

- Residential building programs—including programs to promote higher efficiency new and existing homes, and the expanded use of renewable energy in residences, with specific programs focused on the often under-served low-income and rental properties segments;¹⁰
- Commercial and industrial building programs, including efficiency programs for new and existing buildings, and renewable energy programs for commercial and industrial buildings; and
- Multi-sector strategies, including demand response and demand reduction programs, technical assistance, education, training, consumer outreach, and promotional activities to support the DSM programs, and grants, loans, performance contracting arrangements, and

¹⁰ See the RCI Options Descriptions in Appendix E, and the discussion of existing programs in these areas developed by the State Energy Office, Appalachian State University, and others provided in Annex A to Appendix E.

other incentive programs to provide financial support or incentives for implementation of DSM programs.

RCI-2 Expand Energy Efficiency Funds

The CAPAG recommends that North Carolina’s existing Public Benefits Charge be significantly increased to support more investments in energy efficiency and renewable energy options. The public benefits charge (sometimes call systems benefits charge) is a fee assessed to utility customers based on their usage of energy in a given time period. With deregulation in many states, utility commissions often lose the ability to require the electric utilities to have efficiency programs. The result in many states is the development of the public benefits charge, which is a non-bypassable charge on electric bills. The funds collected are then provided to a third party to provide energy efficiency programming. The CAPAG recommends that these increased public benefits charges be collected under the oversight of the NC Utilities Commission, and invested in residential, commercial, and industrial energy efficiency and renewable energy programs through one or more third-party administrators. Long-term consistency in management and dedicated application of funds collected via public benefits charges to the target programs will be crucial to the success of this initiative.

Investments in energy efficiency and renewable energy made using public benefits funds would be expected to span a wide variety of residential, commercial and industrial applications.

The CAPAG set the goal of this option as providing public benefit charges adequate to implement energy efficiency and renewable energy programs comparable to the more effective public benefits charge-funded programs in the United States. Based on information on energy efficiency programs in other states, 1% of utility revenues was chosen as an appropriate public benefits charge goal for North Carolina at present.¹¹

RCI-3 Energy Efficiency Requirements for Government Buildings

Recognizing that governments should “lead by example” the CAPAG recommends that energy use targets be set and worked toward to improve the efficiency of energy use in State and local government buildings. This option sets energy-efficiency goals for the existing government building stock, as well as for new construction and major renovations of government buildings.¹²

Elements of this option include:

- Adherence by new and renovated government buildings to specific energy-related guidelines providing considerable improvement in building energy performance relative to standard practice, with a specific goal of reducing the energy consumption per square foot of government building area in North Carolina by 20% by 2027.

¹¹ The recently enacted Senate Bill 3, as referenced above, includes some similar elements to those proposed in this option.

¹² Note that some of the elements of this option have been included in the recently-signed Senate Bill 668, “Energy Conservation in State Buildings.” See <http://www.ncleg.net/Sessions/2007/Bills/Senate/HTML/S668v6.html>

- Revising administrative policies as needed to provide incentives for government organizations to invest in increased energy-efficient construction or building alterations.
- Extending green campus initiatives to all public academic and government campuses.
- Energy benchmarking, measurement, and tracking programs for municipal and state buildings.
- Energy efficiency and renewable energy requirements for new, renovated, and existing government buildings.

RCI-4 Market Transformation and Technology Development Programs

The CAPAG recommends that North Carolina develop long-term and robust market transformation and technology development programs. Such programs must provide 1) consistent and enduring support for technology improvement and incorporation, 2) continued investment in technology development and integration, and 3) independent evaluation of the efficacy of the technologies.

This recommendation is broadly defined and does not address a particular technology or market. Rather, it addresses a method for bringing appropriate technologies and processes to the marketplace. Defined as such, the CAPAG recommends that the following components be included in market transformation strategies for North Carolina, though others can and should be included as well:

- Expand existing programs to promote the appropriate use of premium motors and drives in industrial applications.
- Provide renewed and intensified support for implementation of renewable energy applications such as solar water heaters.
- Target the early retirement of older appliances using a “bounty” program.
- Provide support for processes that recover waste heat from industrial applications, and promote the use of ground-source heat pumps by helping to identify and qualify appropriate applications in the residential, commercial and industrial sectors.
- Encourage national legislators to provide increased federal funding for the U.S. Environmental Protection Agency’s ENERGY STAR program in order to identify and qualify a greater number of products under ENERGY STAR labeling.
- Encourage and enable smaller purchasers to act in aggregate groups to reduce costs and quantify emission reduction benefits from technology and process improvements. This could include, for example, setting up programs to organize consumers and to work with them to provide information resources to evaluate and take advantage of savings emissions reduction opportunities.
- Provide a continuous funding level for near-term research and deployment of energy efficient technologies and processes, including providing stable or expanded state funding for existing programs and new initiatives.

Implementation of market transformation programs requires the participation and buy-in of industry partners, regulatory bodies and consumer groups.

RCI-5 Improved Appliance and Equipment Efficiency Standards

The CAPAG recommends that North Carolina should replicate the appliance and equipment efficiency standards adopted in other states for appliances not covered by federal standards.¹³ As part of this action, the CAPAG recommends that the State, working together with other states in, should advocate for stronger federal appliance efficiency standards where doing so is technically feasible and economically justified.¹⁴ Implementation of stronger-than-federal standards together with other states is much preferred by the CAPAG, as it provides a broader market for manufacturers and thus lowers net costs of higher-efficiency devices to North Carolina consumers. The CAPAG recommends that development of new standards start in 2010, with implementation starting in 2012.

Elements of this mitigation option include:

- Development of committee or other working group to develop recommendations on appliance standards (similar to, for example, the existing North Carolina group that considers building code changes).
- Adoption of State-level Appliance Efficiency Standards, defined sufficiently broadly to include, for example, commercial sector and information technology (IT) equipment.
- The CAPAG voices support for adoption of more stringent federal-level appliance efficiency standards, and recommends that North Carolina's congressional delegation and state government officials voice support for such standards.
- Design standards for recycling of materials in appliances, and include water use reduction as a criterion for appliance efficiency improvement.
- Assistance programs to help low-income consumers with purchase of appliances meeting more stringent standards, so as to reduce the higher-first-cost burden of higher-efficiency appliances on those consumers.
- Introduce elevated energy standards for appliances and equipment purchased by public agencies.
- Encourage state agencies, utilities, and other organizations involved in appliance and equipment efficiency programs to work with manufacturers to identify devices where significant savings are possible, and to consider cost and technical impacts on manufacturers—and how to address those impacts—when setting new standards.

¹³ A few examples here of devices not currently covered by Federal standards are commercial boilers, distribution transformers, and AC to DC power supplies. See www.standardsasap.org and Appendix E.

¹⁴ For example, where changes in efficiency can be implemented by manufacturers in such a manner that the value of energy savings, and perhaps eventually the value of GHG emissions savings, is greater than equal to the increased cost of production of the appliance or equipment.

The CAPAG recommends that North Carolina upgrade the energy-efficiency provisions of its building codes, and hasten implementation of standards already adopted or awaiting adoption. Building energy codes specify minimum energy efficiency requirements for new buildings or for existing buildings undergoing a major renovation. As energy use (largely electricity and gas) in buildings in North Carolina accounts for about one-third of current emissions, amending the Building Codes to make the requirements for minimum energy efficiency levels in buildings more stringent will have a considerable immediate and ongoing impact in reducing building-sector greenhouse gas emissions.

An ongoing process of code amendments for new and renovated residential and commercial buildings is proposed as follows.¹⁵

- North Carolina should adopt more stringent building codes to improve the efficiency of energy use in buildings.
- North Carolina should move toward adopting innovative features of advanced codes being implemented in other states, such as lighting efficiency requirements in new homes that go beyond the codes in force, as appropriate to conditions in the State.
- Statewide enforcement of both existing and new building codes should be improved at all levels, and enforcement should be fully implemented within 6 months of statewide code adoption (if applicable).
- North Carolina should regularly update its energy codes to assure that they remain consistent with stringent codes in use nationally and internationally. A three-year cycle of code review and improvement could be timed to coincide with the release of national model codes.
- As appropriate, codes should be modified to remove obstacles to renewable energy use, daylighting and non-conventional energy-efficient building materials in buildings where applicable.
- Include programs of expanded, more accessible and intensified education for building inspectors and other building industry professionals to assure that the new codes are implemented and enforced.

The CAPAG recommends 95% enforcement of existing building energy codes by 2008, and establishment and similar enforcement of a new energy code by 2010 that requires new North Carolina residences and commercial/industrial buildings to be 20% more efficient than buildings meeting current national building energy codes.

¹⁵ As with other RCI options, please see Appendix E for additional details on the suggested building code improvements.

RCI-7 “Beyond Code” Building Design Incentives and Targets, Incorporating Local Building Materials and Advanced Construction

Energy use in existing buildings and in non-government-funded new buildings must be substantially improved. The CAPAG recommends that incentives and targets be provided and developed to induce the owners and developers of new and existing non-government buildings to markedly improve the efficiency with which energy and other resources are used in those buildings, along with provisions for raising targets periodically and resources to help achieve the desired building performance. This option includes elements to encourage the improvement and review of energy use goals over time, and to encourage flexibility in contracting arrangements to encourage integrated energy and resource efficient design and construction.

Elements of this option include:

- Promotion and Incentives for “beyond code” construction, using programs of various types to focus on specific sectors (new home construction, apartments, low income housing, commercial new construction, commercial renovation construction, and others), with improved design and construction standards and guidelines addressing multiple aspects of resource conservation.
- Promotion of energy technologies include solar water heating and solar heating/cooling building technologies, solar photovoltaic power on commercial buildings and many new homes, solar hot water heaters on homes and other buildings, new and existing lighting building energy technologies, and other applicable new technologies.
- Promotion of energy education under this option in coordination with the programs noted in RCI-8.
- The goals of this option are to induce 5% of new residential buildings and 2% of new commercial buildings annually to go to “beyond code” energy use levels that improve energy performance over the average new building by 30%, to induce significant examples throughout the state of various building types that use 50% or less energy than is supported by the existing building code, and to provide incentives such that energy efficiency in 20% of existing buildings is increase by 15% by 2015, and energy efficiency in 20% of existing commercial building energy performance is increased by 20%. These goals are intended to be in addition to privately and publicly-sponsored efforts at “beyond code” construction now ongoing in North Carolina.

RCI-8 Education (Consumer, Primary/Secondary, Post-Secondary/Specialist, College and University Programs)

The CAPAG notes that the effectiveness of emissions reduction activities in many cases depends on providing information and education to consumers, as well as to future consumers (primary and secondary school students), regarding the energy and greenhouse gas emissions implications of consumer choices. As a consequence, the CAPAG recommends that consumer and primary/secondary schools education programs focused on these issues be created in North Carolina, or augmented and expanded where they exist already. In addition, in order to

effectively implement many of the other RCI options above, specific and targeted education (at the community college, university, and post-graduate levels), outreach, and licensing requirements will be required for professionals in a variety of building-related trades in order to ensure that those professionals have the expertise to support aggressive GHG mitigation options in North Carolina. State support for such programs will help to build a pool of trained professionals that will benefit the state for years to come.

Training and education activities under this option should be implemented so as to fully support other RCI options, and options in other areas as applicable, and should be timed and provided at levels appropriate so as to build understanding and awareness of energy and environmental issues, and human capacity in the field (skilled worker and professionals) so that capacity will be ready when needed by the people and businesses of North Carolina.

Elements of this option include training, education, and certification for builders and contractors, training and certification of building code and other officials in energy code enforcement, energy management training and training of building operators, continuing education for building design professionals, including architects, engineers, developers, contractors, urban planners, and realtors, energy efficiency and related education introduced at community colleges and trade schools, consumer education and consumer information programs (building on efforts to date by the State Energy Office, the NC Energy Research Center at Appalachian State University, and others), and introduction/augmenting of energy and environmental curricula in schools.

RCI-9 Green Power Purchasing (required for State facilities) and Bulk Purchasing Programs for Energy Efficiency or Other Equipment

The CAPAG recommends that the use of “green power” in North Carolina be significantly expanded, and that public- and private-sector programs for the bulk purchase of high-efficiency appliances and equipment be developed. “Green power” supplements the state’s existing power supply with electricity generated from renewable resources like the sun, wind and organic matter. This option expands an existing voluntary North Carolina program by making green power purchases mandatory for State facilities. As part of this strategy, the CAPAG also recommends establishing a program for the bulk purchase of appliances and equipment with higher-than-standard energy efficiency by public agencies, and for the organization of similar bulk-purchase programs in the private sector.

The CAPAG recommends that State facilities purchase energy through NC GreenPower or a similar green power provider to cover 20% of their power needs by 2018, over and above the requirements of renewable generation within an Environmental Portfolio Standard or similar requirement applying to electricity suppliers. This target would be phased in starting in 2008. Additionally, for bulk purchases, the CAPAG recommends a program to address purchases of 10% of electricity-consuming equipment purchased annually by state agencies, and 1% of electricity-consuming equipment purchased annually by all commercial/institutional sector consumers. Devices purchased under the energy efficiency bulk purchase program would have a target consumption of 20% less electricity, on average, than devices that would otherwise have been purchased.

RCI-10 Distributed Renewable and Clean Fossil Fuel Power Generation

The CAPAG recommends that implementation of distributed renewable and clean fossil fuel power generation systems of less than 10 MW be encouraged through a combination of regulatory changes and incentive programs. Distributed generation with clean power systems reduces fossil fuel use and greenhouse gas emissions as well as providing electricity system benefits.¹⁶ Elements of this program include:

- Review existing net-metering policies (or check that the most recent North Carolina reviews of these policies are complete), including policies that affect electricity consumers who install on-site combined heat and power or distributed generation fueled with renewable or fossil fuels.
- Review as needed, and in consultation with the NC Utilities Commission, rate issues in NC, including the potential for decoupling of utility revenues from sales and rate design, with a specific focus on the impacts of rate design on greenhouse gas emissions.
- Provide incentives, including, as needed, increasing existing tax and utility incentives, for renewable energy applications such as photovoltaics and other renewable power sources, sufficient to reach the renewable energy development goals below.
- Promote clean combined heat and power in all sectors through, for example, a combination of utility incentives, information provision, streamlining of connection requirements, providing low-interest loans, and/or tax credits for potential hosts/owners/developers of these systems.
- Funding of research and development for distributed renewable and clean fossil fuel power generation, and provide direct or indirect support for in-state commercialization and production of new or advanced technologies for distributed renewable and clean fossil fuel power generation.
- Encourage the development of building-integrated distributed renewable and clean fossil-fuel power generation.

The goal of the program would be to implement 25%–33% of North Carolina’s combined heat and power potential by 2020. An additional 2% to 4% of all NC homes will have solar hot water installations by 2020. This option also includes the goal of implementing 35 additional MW of distributed renewable generation over and above renewable portfolio standard-related new generation by 2020.

RCI-11 Residential, Commercial, and Industrial Energy and Emissions Technical Assistance and Recommended Measure Implementation

The CAPAG recommends that technical assistance be provided to help identify options for energy consumers to reduce fossil energy use and to reduce non-energy emissions of GHGs, and that consumers be provided with information and incentives allowing them to follow-up on that

¹⁶ Electric system benefits can include, for example, reducing the need for transmission and distribution capacity by providing generation at the local level, and providing voltage and frequency support.

assistance to implement recommended measures. This initiative may include the following elements:

- Residential energy technical assistance for existing homes that identifies the most cost-effective energy efficiency measures for the individual homes visited. The technical assistance program can include diagnostic testing and analysis specific to the features of the home being investigated. The results reported to the homeowner can provide estimates of energy use, energy cost savings, and reductions in emissions due to implementation of the recommended measures.
- Commercial energy technical assistance for existing commercial buildings similar to the residential services, but most likely not including diagnostic testing. The analysis associated with technical assistance can also consider the benefit to the individual businesses visited of being served under alternative utility rate structures and of taking advantage of load control opportunities.
- Industrial energy technical assistance that identifies key efficiency measures, such as process heat changes, motor efficiency improvements, boiler efficiency provisions, compressed air system measures, as well as lighting and building envelope efficiency improvements. The industrial technical assistance program can identify opportunities for capture and use of process heat, as well as for implementation of combined heat and power. Opportunities for reducing the use of non-energy greenhouse gases can also be considered. Evaluation of the benefit to the individual plants visited of being served under alternative utility rate structures and assessments of load control opportunities can be included as well.
- The technical assistance programs can include follow-up mechanisms by which those who receive services are contacted at least twice after receiving the results to answer questions and give suggestions for installing the recommended measures, and to provide access to incentives (such as grants to cover a portion of the incremental cost of efficiency improvements) and financial assistance (such as low-interest loans) to encourage implementation of recommendations.

Initial goals for this option are to provide over 10,000 residential technical assistance visits, 1,500 commercial building technical assistance visits, and 300 industrial technical assistance visits annually once the technical assistance programs are fully implemented, and to have over 50% of consumers provided with assistance visits implement measures providing at least 50% of the GHG emission reduction potential of the recommendations. The CAPAG recommends that these goals be increased if needed, over time, to help to fully implement other RCI options.