

**Residential Commercial and Industrial Technical Work Group
Summary List of Mitigation Options**

	Mitigation Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2007-2020 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Status of Option
		2010	2020	Total 2007-2020			
RCI-1	Demand Side Management Programs for the Residential, Commercial and Industrial Sectors						
	Recommended Case: "Top-ten States" EE Investment	1.9	11.6	77.1	-\$1,895	-\$25	Completed
RCI-2	Expand Energy Efficiency Funds	1.5	8.0	54.8	-\$1,346	-\$25	Completed
RCI-3	Energy Efficiency Requirements for Government Buildings	0.0	1.1	6.4	-\$88	-\$14	Completed
RCI-4	Market Transformation and Technology Development Programs	0.0	2.0	10.5	-\$339	-\$32	Completed
RCI-5	Improved Appliance and Equipment Efficiency Standards	0.0	1.0	5.3	-\$336	-\$63	Completed
RCI-6	Building Energy Codes	0.5	3.5	23.1	-\$400	-\$17	Completed
RCI-7	"Beyond Code" Building Design Incentives and Targets, Incorporating Local Building Materials and Advanced Construction	0.7	5.2	34.2	-\$494	-\$14	Completed
RCI-8	Education (Consumer, Primary/Secondary, Post-Secondary/Specialist, College and University Programs)	<i>Not quantified</i>					Completed

	Mitigation Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2007–2020 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Status of Option
		2010	2020	Total 2007–2020			
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	Pending
RCI-10	Distributed Renewable and Clean Fossil Fuel Power Generation	1.2	4.6	33.5	\$392	\$2412	Completed
RCI-11	Residential, Commercial, and Industrial Energy and Emissions Technical Assistance and Recommended Measure Implementation	0.5	2.1	14.9	-\$494	-\$33	Completed
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS	5.3	33.0	218.7	-\$3,994	-\$18	N/A
	REDUCTIONS FROM RECENT ACTIONS						
RCI-1	Demand Side Management Programs for the Residential, Commercial and Industrial Sectors	0.3	0.7	6.2			N/A
RCI-2	Expand Energy Efficiency Funds	0.2	0.4	3.6			N/A
RCI-6	Building Energy Codes	0.0	0.0	0.0			N/A
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			N/A
	SECTOR TOTAL PLUS RECENT ACTIONS	5.8	34.2	228.5			N/A

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

NOTES: This document presents revised drafts of Mitigation Option Descriptions for those options that the CAPAG has designated as being high priority for elaboration and further

analysis. As in previous versions of this document, these drafts include edits provided by the RCI TWG and the CAPAG in meetings to-date, including the RCI TWG teleconference meeting on 4/17/07 and the CAPAG meeting of 5/8/07. In a limited number of instances, additional North Carolina-specific data will be added to the analysis, and the RCI TWG has been requested to provide some additional inputs as to sources of data as well as reasonable assumptions for use in refining analyses, particularly in instances where there remains generic text, placeholder estimates, and questions in *italics* for the TWG and CAPAG consideration. **Substantive changes in this document that have been made since the last CAPAG meeting are presented in yellow highlights to make the document easier for the TWG to review prior to the 6/13 TWG meeting.**

As always, previous versions of this document are available on

http://www.ncclimatechange.us/Residential_Commercial_Industrial.cfm.

Substantial input on **Related Policies/Programs in Place** was provided by RCI TWG members, especially focusing on State Energy Office (SEO) and State Energy Plan (SEP) policies and programs. As many of these policies and programs are relevant to more than one of the RCI Options, we have established Annex A (provided with analysis workpapers--Annex B--in a accompanying document) that provides detail on these policies, and retained only the titles of the policies in the “Related Policies/Programs section for the RCI individual options. SEO Contract refers to contracts currently in place with the State Energy Office for the services outlined. Note that SEO and SEP reference information may not yet have been included with all relevant options.

Acronyms used in several places in this document:

CAPAG – Climate Action Plan Advisory Group

CHP – Combined Heat and Power

CO₂ – Carbon Dioxide

CSA – Clean Smokestacks Act of 2002

DENR – Department of Environment and Natural Resources

DG – Distributed Generation

DSM – Demand Side Management

HVAC – Heating, Ventilation, and Air Conditioning

LPG – Liquefied Petroleum Gas (Propane/Butane)

RCI – Residential, Commercial, and Industrial

SEO – State Energy Office

SEP – State Energy Plan

SWH – Solar Water Heating

TWG – Technical Working Group

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

Mitigation Option Description

Utility-funded Demand Side Management (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. This option is designed to work in tandem with other strategies under consideration by the RCI TWG and by other TWGs that can also encourage efficiency gains.

Mitigation Option Design

It is recommended that 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.

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

- Efficiency programs for new residences, such as ENERGY STAR[®], Environments for Living, HealthyBuilt Home, LEED-H, or other programs.
- Efficiency programs for existing residences, such as Home Performance with ENERGY STAR. Development of this program should follow a comprehensive survey and analysis of existing residences to determine key strategies that will provide the greatest impact for the least investment.
- Renewable energy programs for new and existing residences.¹
- Programs focused on low-income weatherization of new and existing homes (such as Systems Vision).
- Programs focused on rental properties.

¹ Including cost-effective alternatives to fossil-fuel-based energy, such as solar water heating, passive solar designs, solar space heating and pool heating (only to replace electric or fossil fuel-based existing pool heating), residential biofuels, photovoltaics, and other strategies.

Commercial and Industrial Building Programs

- Efficiency programs for new commercial buildings, using commercial ENERGY STAR and LEED-NC as starting points.
- Efficiency programs for existing commercial buildings, using the work of the State Energy Office's Utility Savings Initiative, ongoing energy audit and technical services, and previous programs, such as the federally funded Institutional Conservation Program, and programs in other states, as additional sources.
- Efficiency programs for new and existing industrial facilities, based on ongoing efforts of North Carolina State's Industrial Energy Extension Service and Industrial Assessment Center, Advanced Energy's industrial efficiency programs, and other related projects.
- Renewable energy programs for new and existing commercial buildings and industrial facilities, with the same focus as renewable energy programs for new and existing residences.

Other Multi-sector Strategies

- Demand response and demand reduction programs for all sectors.
- Technical assistance, education, training, consumer outreach, and promotional activities to support the DSM programs.
- Grants, loans, performance contracting arrangements, and other incentive programs to provide financial support or incentives for implementation of DSM programs.

Goals: The goal for this option as originally specified by the RCI TWG was as follows: "At a minimum, utilities must offset projected growth in emissions from the inventory base year from RCI utility gas and electricity use. If practical, make substantial additional reductions so that costs of reduction are equal to avoided energy costs. Achieving savings beyond offsetting growth is desirable, but it is recognized that at some level of expenditure, additional investments will achieve diminishing returns. It is expected that savings through electricity sector DSM programs will offset both peak load power and the need for new peak load facilities." Following discussion of this option at its meeting on 1/24/07, the CAPAG directed the RCI TWG to reconsider this goal, in part due to concerns that it is too ambitious. During its meeting on 4/17/07, the RCI TWG reached consensus on a DSM investment goal of 1.5 percent of utility revenues. This level of investment would have placed North Carolina among the top ten US States in DSM investment per unit electricity sales revenue, based on a national compilation of energy efficiency investment for the year 2003.²

² ACEEE's 3rd National Scorecard on Utility and Public Benefits Energy Efficiency Programs: A National Review and Update of State-Level Activity. By Dan York and Marty Kushler of the American Council for an Energy-Efficient Economy. Report No. U054, Dated October, 2005. See also rankings presented in ² A Study of the Feasibility of Energy Efficiency as an Eligible Resource as Part of a Renewable Portfolio Standard for the State of North Carolina, dated December 2006, and prepared as a report for the North Carolina Utilities Commission by GDS Associates, Inc.

Timing: Start ramping up programs from existing levels starting in 2007, reaching goal levels by 2012.

Parties Involved:

- **Utilities:** Through the rate-making process, utilities and the North Carolina Utilities Commission will develop a mechanism to include the cost of DSM programs in the respective utility's rate base, or provide for a separate surcharge that utility customers pay.
- **State Agencies:** The North Carolina Utilities Commission, the Public Staff, the State Energy Office, the Department of Environmental and Natural Resources, the State Construction Office, and others shall be involved in the design and implementation of the DSM programs.
- **Third-party efficiency Providers:** North Carolina has considerable expertise in its universities, nonprofit organizations, and private consulting and technical service companies to provide services for the DSM programs. The overall effort should seek to develop a statewide "efficiency industry" that will expand beyond the efforts of the DSM programs alone.
- **Regulators:** The North Carolina Utilities Commission, with input from the Public Staff, will likely be the approving and oversight body for the programs.
- **Others:** A wide variety of stakeholders will provide input into the development and continued operation of the DSM programs.

Implementation Mechanisms

Demand Side Management programs around the country vary substantially, with dozens of different types of implementation mechanisms. Potential implementation mechanisms and supporting activities for this mitigation option include:

- **Primary Implementation Mechanism:** Utilities will develop and manage their own Demand Side Management Programs, with input from the Utilities Commission and other stakeholders, and with approval from the Utilities Commission, and will include the expenses of the program in the overall rate base.³
- **Overall Management –** There are different options for overall management of utility programs:
 - Each utility manages its own programs.
 - Utilities contract with others (public agencies, non-profit agencies, and/or private contractors) to manage some or all of a utility's programs.
- **Supporting Activities:**
 - Direct payment incentive programs: Utility customers who implement specific efficiency or renewable measures receive partial rebates. For example, builders of

³ The Utilities Commission might also consider offering utility incentives to provide substantial programs.

- ENERGY STAR homes receive an incentive of a given amount per square foot up to a maximum incentive.
- Rebate programs: Utility customers who purchase energy efficient or renewable products receive an incentive payment upon submitting their purchase receipts.
 - Loan programs: Utility customers receive a preferential loan to finance the purchase of high efficiency HVAC systems for commercial buildings.
 - Preferential rates: Participants in load control programs or homebuyers who select (for example) ENERGY STAR homes receive lower rates.
 - Marketing programs: Utilities purchase advertising to promote the DSM programs and recognize those who participate.⁴
 - Technical service programs: Utilities provide directly, through the managing organization, or through subcontractors, technical assistance, analysis, and recommendations.
 - Research and development programs: Utilities support applied research which promises fairly quick implementation, such as high efficiency HVAC and humidity control systems, insulated/non-vented attics, improved commercial ventilation control strategies, and electricity generation from biomass.⁵

Related Policies/Programs in Place

- **SEO CONTRACT, Appalachian State University Energy Center.**
- **SEP Exec-11:** Reduction of energy consumption in State agencies and universities.
- Electric Utilities providing DSM programs include: Progress Energy, Dominion Power, and Duke Energy. Programs are mostly information, with a few financing programs.⁶ Gas utilities and other fuel provider organizations include Piedmont Natural Gas, Scana – Public Service Company North Carolina (PSCNC), North Carolina Propane Gas Association, North Carolina Petroleum Marketers Association, and Carolina Fuel Institute.
- At the 5/23 CAPAG meeting, the Environments for Living program was noted as an example, with builders having built 80,000 homes in the South and Southwest under the program in the last five years.⁷ Also, it was noted that solar water heating is included in the NC Green Power Program.

⁴ Marketing on consumer products programs can include incentives, retailer training, marketing and promotion, education, and similar efforts.

⁵ Such support can include funding of research and development for energy efficiency, and renewable energy, and could be implemented through R&D contracts with private firms, grants and contracts with universities, intramural R&D conducted at government labs, and R&D contracts with private/public consortia.

⁶ Other ongoing programs in North Carolina that are relevant to this option include the Industrial Extension Service (IES) at NCSU, energy and water efficiency programs at the Division of Pollution Prevention and Environmental Assistance (DPPEA), Western Waste Reduction Partners (WRP) and other similar programs. The North Carolina State Energy Office also offers a number of programs in many sectors. See also http://www.seea.us/PDFs/SEEA_DSM.pdf.

⁷ See <http://www.eflhome.com/>.

- The NC HealthyBuilt Homes (HBH) program, supported in part by the NC State Energy Office, has been very active in the State.
- ENERGY STAR Homes is another example of building performance standards and certifications in use in North Carolina.
- Policy on net metering has been established by the NCUC, and corresponding tariffs approved.⁸ The establishment of Small Generator Interconnection Standards is designed to streamline the process for customers seeking to install net metering applications, as well as other small renewable energy generation applications.⁹
- Free refrigerator disposal programs already exist in North Carolina.
- In 1980, the North Carolina Utility Commission (NCUC) established a systems benefit charge, creating a non-profit corporation to administer the funds with the charter “to encourage energy efficient economic development in North Carolina.” The non-profit Advanced Energy operates programs for subsidized and market-rate home construction, and provides energy efficiency assistance to North Carolina industry.¹⁰
- The State Energy Office is involved in federal Industries of the Future. CSA recommendation A-5: Promote and Support Efforts to Establish North Carolina as a World Leader in GHG, Non- Carbon Fuels and Energy Efficiency Technologies SEP promotes further incentives for high efficiency motors.
- **SEO CONTRACT, Energy Management Program**, operated in conjunction with the North Carolina State University Industrial Extension Service.
- **SEO CONTRACT, The Center for Energy Research and Technology.**
- **SEO CONTRACT, Energy Efficiency for Nonprofits.**
- **SEO CONTRACT, ElectriCities—Energy Auditor.**
- **SEO CONTRACT, Energy Efficiency Field Assistance Waste Reduction Partners.**
- **SEO CONTRACT, Central and Eastern Waste Reduction Partners.**
- **SEP 7-4:** Develop performance contracting procedures and other ways to finance energy efficiency projects for state and local governments, university and public school systems, and public housing.
- Duke power has a special needs low-interest loan program for low-income residents for HVAC equipment and weatherization measures.

Types(s) of GHG Reductions

Principally, the reduction in GHG emissions (largely CO₂) from avoided electricity production and avoided on-site fuel combustion. Less significant are the reduction in CH₄ emissions from avoided fuel combustion and avoided pipeline leakage. Other GHG impacts are also conceivable,

⁸ See Docket No. E-100, Sub 83.

⁹ See Docket No. E-100, Sub 101.

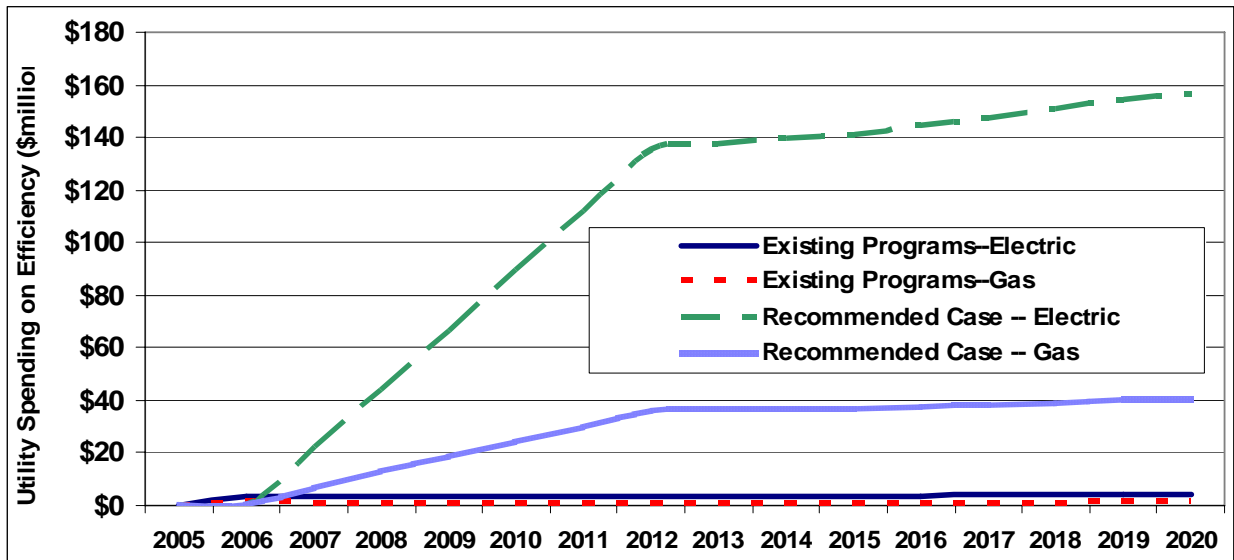
¹⁰ See <http://www.advancedenergy.org/>.

but are likely to be small (black carbon, N₂O) and/or very difficult to estimate (materials use, life cycle, market leakage, etc.).

Estimated GHG Reductions and Costs (or Cost Savings)

The first table below shows the *incremental* savings of this option over and above any savings that are expected to accrue from current utility DSM programs in North Carolina. The chart compares the overall utility revenues devoted to energy efficiency programs under the RCI-1 option as analyzed (at spending levels required to offset growth in emissions). Please see Annex B to these descriptions for additional details of the analysis of this option.

Demand Side Management Programs for the Residential, Commercial and Industrial Sectors	2010	2020	Units
Recommended Case: "Top-ten States" EE Investment			
GHG Emission Savings	1.9	11.6	MMtCO ₂ e
Net Present Value (2007-2020)		-\$1,895	\$ million
Cumulative Emissions Reductions (2007-2020)		77.1	MMtCO ₂ e
Cost-Effectiveness		-\$25	\$/tCO ₂ e



Data Sources: Costs of DSM programs from a rough average of compilations of program experience for Northwest utilities and estimates for an energy efficiency program as part of a

renewable portfolio standard in North Carolina¹¹ (electric) and from utility programs nationwide (gas).

Quantification Methods: The CAPAG suggests reviewing the interplay of approaches in RCI-1 through RCI-3 when analyzing these options.

Key Assumptions: Sufficient energy efficiency opportunities are available and achievable to offset growth in utility sales. Baseline growth in electricity sales are as included in the Inventory and Forecast prepared for the CAPAG.¹²

Key Uncertainties

- North Carolina-specific costs of DSM programs at savings levels modeled.
- Levels of spending/savings from Existing DSM programs in North Carolina.
- Impact of electricity energy efficiency programs on peak demand as well as energy requirements.¹³
- CAPAG representatives suggested that the value used to estimate electricity transmission and distribution losses in North Carolina (and thus the net impact of demand-side electricity savings and generation on generation at central power plants), 9.5% of power plant generation (throughout the inventory and forecast period) is too high, at least for the two largest utilities in the state, and suggested that this value be revisited. Note that subsequent to the 1/24/07 CAPAG meeting alternative Transmission and Distribution loss fractions have been adopted, and have been updated following the 5/11/07 meeting to start at 6.3 percent of generation in 2006, and falling to 5.6 percent of generation by 2020. These values are consistent with those used for evaluation of energy supply options related to the electricity sector.

Additional Benefits and Costs

Benefits

- Reducing use of electricity and natural gas through this option also reduces emissions of local and regional air pollutants, such as sulfur and nitrogen oxides, which in turn reduce the human health and other impacts of those emissions.¹⁴
- Co-benefits include transmission/distribution system costs reduction

Costs

¹¹ GDS Associates, Inc. Report for the NC Utilities Commission, *A Study of the Feasibility of Energy Efficiency as an Eligible Resource as Part of a Renewable Portfolio Standard for the State of North Carolina*, dated 12/2006.

¹² At the January 24 CAPAG meeting, a CAPAG member expressed doubts that sufficient generation and/or imports would be available in North Carolina to meet the future levels of electricity demand included in the baseline forecast.

¹³ TWG members requested estimates of the impacts of RCI-1 and other options on peak power demand as well as on electric energy requirements. The magnitude of changes to peak power demand could affect both avoided costs and avoided GHG emissions associated with energy efficiency actions.

¹⁴ Tools such as the EPA's COBRA (Co-benefits Risk Assessment Model) and BenMAP (Environmental Benefits Mapping and Analysis Program) can be used to obtain estimates for the economic benefits of reduction of non-GHG air pollutant emissions that accompany GHG emissions reduction.

None Cited.

Feasibility Issues

- Costs and performance vary substantially between measures that might be considered for DSM programs. Some measures may present low capital costs and higher operating costs (or vice versa), and there is uncertainty about the costs and savings for other measures.
- Interaction with appliance standards and utility programs.

Status of Group Approval

Completed.

Level of Group Support

Unanimous Consent.

Barriers to Consensus

None.

RCI-2 Expand Energy Efficiency Funds

Mitigation Option Description

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, the 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.

Mitigation Option Design

It is recommended that North Carolina's existing Public Benefits Charge be significantly increased to support more investments in energy efficiency and a renewable energy option. While the State has a well-established public benefits charge and fund, the charge to consumers has not changed since its inception in 1980. Since that time, other states have implemented public benefits charges that are significantly higher than in North Carolina. If North Carolina were to raise its public benefits charge to the level of the national average collected by other states, funds collected would be more than 20 times higher. The increased charge in other states has allowed them to take the lead and drive energy efficiency both locally and nationally.¹⁵

It is recommended 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.¹⁶

Goals: Reduce greenhouse gas emissions from RCI activities by 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. Information from a national compilation on existing and planned electric utility spending on energy

¹⁵ Because almost all public benefit charges are currently assessed in cold weather states, the majority of research and program development has been directed to issues faced in the Northeast and Northwest. While some of these programs can be translated to North Carolina, many cannot, due to differing electric rates and climates. Unfortunately, there are no substantial public benefits programs in the Southeast, leaving the area shallow in terms of energy efficiency programs at a time when population growth is pushing electric demand to new highs.

¹⁶ Applications could include (but would by no means be limited to) measures such as solar-powered (absorption) air conditioning, ground-source heat pumps, and efficiency improvement programs for window AC units, lighting, water heating, plug loads, networked PC management, power supplies, motors, pumps, boilers, and other appliances and equipment.

efficiency programs in other states was reviewed, and indicated spending in the range from a fraction of one percent to approximately three percent of utility revenues. On that basis, one percent (1%) of utility revenues was chosen as an appropriate public benefits charge goal for North Carolina at present.

Timing: Three year phase-in of public benefits charges from the current level to a level consistent with the goals above.¹⁷

Parties Involved: The public benefits charge is collected from customers of all gas and electric utilities. The collected Public Benefits Funds is then spent on energy efficiency and renewable energy investments in all sectors. All relevant stakeholder groups are involved in the design, governance and oversight, management, and implementation of programs to invest these funds.

Implementation Mechanisms

As stated above, we believe the most effective implementation method is to work through the NC Utilities Commission to increase funding in the established program. While funding will increase, funding allocations do not have to stay the same.

Potential implementation mechanisms and supporting activities for this mitigation option include:

- Provide programs with substantial incentives for consumers to participate, and that include retailer training, marketing and promotion, education, and other elements designed to ensure program effectiveness.
- Funding of Research and Development for Energy Efficiency, Renewable Energy, and Other GHG Reduction Strategies. Funding from the Public Benefits Charge can in part be used for R&D contracts with private firms, grants and contracts with universities, intramural R&D conducted at government labs, and/or R&D contracts with private/public consortia.
- Performance-based Contracting for funding of energy efficiency improvements, with capital costs paid back through energy savings.
- Establishment of a Reinvestment Fund providing financing for energy-efficiency and other GHG emissions-reduction efforts. This fund would be used in part to create infrastructure to deliver energy- efficiency and renewable technologies. Allowing state agencies to keep the net savings from energy efficiency actions undertaken with the use of public benefits funds, or to reinvest savings in energy-efficiency or other projects, will be crucial to the success of fund initiatives in the public sector. The Reinvestment Fund can take the form of a Special capital fund for businesses developing renewable energy sources, such as the Pennsylvania “Energy Harvest” program.

Related Policies/Programs in Place

- North Carolina has the oldest public benefits charge program, established in 1980 by the NC Utilities Commission. The original intent of this program was to reduce electric

¹⁷ In other states, a dramatic increase in public benefits funding levels has led to severe growing pains as administration of such funding was difficult to develop. A three-year plan of implementation can allow expectations to be more effectively set and realized.

demand in an effort to slow the need for new power plant construction. The current public benefits charge of 0.003567 cents per kWh translates to approximately three cents per month per average residential customer in the State. The total collected amounts to about \$3.5 million per year. These funds are used for energy efficiency and economic development programs throughout the state. Because of the small amount of funding, efforts have been specialized to serve specific markets in the state. Industrial motors and process heating receive much of the attention in an effort to make our industries more efficient and competitive, thereby retaining and building the job base. The other primary area of funding is the residential new construction sector.

- CSA recommendation LT-5, *Develop a Public Benefits Fund*.
- NCUC is presently investigating several issues involving DSM and Energy Efficiency in the current Integrated Resource Planning.¹⁸ This investigation includes Public Benefit Funds.
- In 1980 the North Carolina Utility Commission (NCUC) established a systems benefit charge, creating a non-profit corporation to administer the funds with the charter “to encourage energy efficient economic development in North Carolina.” The non-profit Advanced Energy operates programs for subsidized and market-rate home construction, and provides energy efficiency assistance to North Carolina industry.¹⁹
- It was noted during the 5/23 CAPAG meeting that the NC Tax Credit for Renewable Technology Investment has “sunsetted” (lapsed), and should be brought back (or replaced with a program with similar goals).
- **SEP Exec-8:** Reexamine existing legislation and regulations as pertains to barriers and strategies to develop wind energy while still protecting North Carolina’s natural beauty.
- **SEP Exec-9:** Incentives and regulatory or administrative measures for development of renewable electricity generation facilities, solar water heating, passive and active solar space heating, and daylighting.
- **SEP Exec-13:** Facilitate efforts of local governments to finance energy efficiency and renewable energy projects.
- **SEP 4-1:** The North Carolina Utilities Commission is encouraged to promote policies that create diversity in energy supply such as natural gas, solar energy, wind energy, biomass, and hydrogen from renewable sources with particular emphasis on in-state energy development.
- **SEP 7-4:** Development of performance contracting procedures and other ways to finance energy efficiency projects for state and local governments, university and public school systems, and public housing.
- **SEP 8-6:** Continue its work to formulate and advance mortgage-based incentives for high performance new homes.

¹⁸ See in Docket No. E-100, Sub 110.

¹⁹ See [http://www.advancedenergy.org/\(6.9\)](http://www.advancedenergy.org/(6.9)).

- **SEP 9-2:** Promotion and development of guidelines for performance contracts, conduct workshops, and provide technical assistance on developing performance contracting documents.

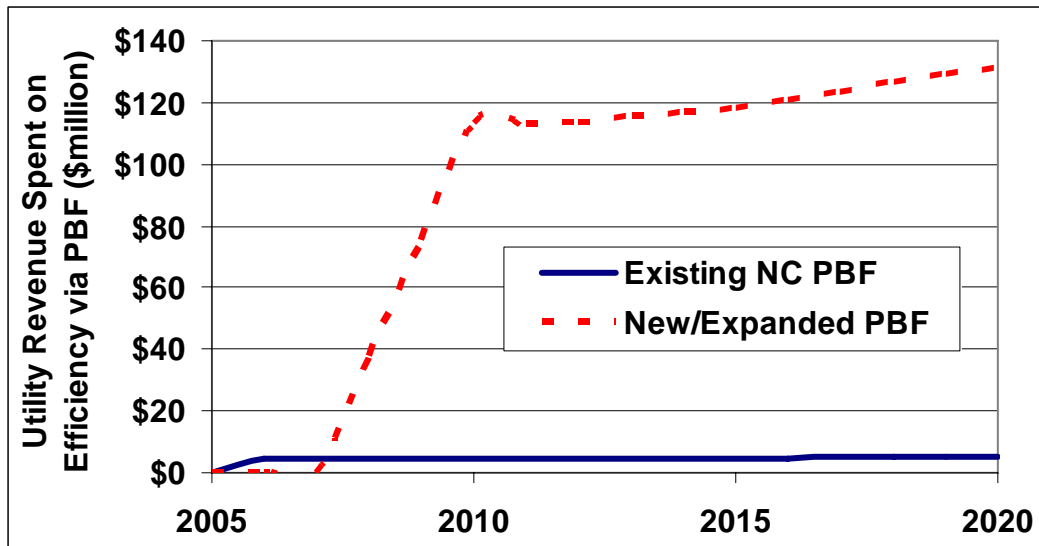
Types(s) of GHG Reductions

As with RCI-1, this option would principally yield reductions in GHG emissions (largely CO₂) from avoided electricity production and avoided on-site fuel combustion. Less significant are the reduction in CH₄ emissions from avoided fuel combustion and avoided pipeline leakage. Other GHG impacts are also conceivable, but are likely to be small (black carbon, N₂O) and/or very difficult to estimate (materials use, life cycle, market leakage, etc.).

Estimated GHG Reductions and Costs (or Cost Savings)

The first table below shows the *incremental* savings of this option over and above any savings that are expected to accrue from the current public benefits program in North Carolina. The chart compares the overall utility revenues devoted to public benefits under the RCI-2 option as analyzed. Please see Annex B under these descriptions for additional details of the analysis of this option.

Expand Energy Efficiency Funds	2010	2020	Units
GHG Emission Savings	1.5	8.0	MMtCO ₂ e
Net Present Value (2007-2020)		-\$1,346	\$ million
Cumulative Emissions Reductions (2007-2020)		54.8	MMtCO ₂ e
Cost-Effectiveness		-\$25	\$/tCO ₂ e



Data Sources: Costs of DSM programs from a rough average of compilations of program experience for Northwest utilities and estimates for an energy efficiency program as part of a renewable portfolio standard in North Carolina²⁰ (electric) and from utility programs nationwide (gas).

Quantification Methods: The CAPAG suggests reviewing the interplay of approaches in RCI-1 through RCI-3 when analyzing these options.

Key Assumptions: 1% of utility electric and gas revenues are spent annually on public benefits programs (assumed mostly energy efficiency).

Key Uncertainties

- North Carolina-specific costs of energy efficiency investments at savings levels modeled.
- Future expected levels of spending vs. savings from public benefits charge program in North Carolina

Additional Benefits and Costs

Benefits

- Co-benefits could include transmission/distribution system costs reduction.
- Would help to provide local employment and grow renewable energy use.

Costs

None Cited.

Feasibility Issues

- Costs for this option are uncertain, depending on measures included.
- Interaction with appliance standards and utility programs needs to be taken into account.

Status of Group Approval

Completed.

Level of Group Support

Unanimous Consent.

Barriers to Consensus

None.

²⁰ GDS Associates, Inc. Report for the NC Utilities Commission, *A Study of the Feasibility of Energy Efficiency as an Eligible Resource as Part of a Renewable Portfolio Standard for the State of North Carolina*, dated 12/2006.

RCI-3 Energy Efficiency Requirements for Government Buildings

Mitigation Option Description

Recognizing that governments should “lead by example” the option presented here provides energy use targets 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.

Mitigation Option Design

Elements of this Option Design include:

- Adherence by new and renovated government buildings to the energy-related guidelines included in LEED + (Leadership in Energy and Environmental Design), a national building certification program that currently exists in the commercial building arena but would have **more explicit energy efficiency requirements** than LEED alone. Conversion of existing buildings to bring them into compliance with the LEED + standard.
- Revise the existing policy(s) that separates construction budgets from maintenance budgets. By linking these, the increased energy efficient construction or alterations will be seen as long term savings.
- Extend green campus initiatives to all public academic and government campuses.
- Energy benchmarking, measurement, and tracking programs for municipal and state buildings.
- Energy efficiency requirements for new, renovated, and existing government buildings.
- Renewable energy requirements for new, renovated, and existing government buildings.

Goals: New construction and major renovations of government buildings must meet LEED+ requirements. Commence with all buildings entering the design phase by 2010. Based on a state composite average, achieve a 20% reduction from a baseline fiscal year of 2002-03 in energy consumption per gross square foot per year for the entire North Carolina government existing building stock by 2027. In the last year of the program, establish a new 5-year goal for government building energy efficiency improvement.²¹

Timing: See the timing targets described in the “goals” section above. This option will build on the USI (Utility Savings Initiative) program already in place at the North Carolina State Energy Office.

²¹ *Should this option cover public housing as well as other government buildings?*

Parties Involved:

- State agencies, UNC System and affiliates, Community College System and K-12 school districts.
- Local governments and other public entities.
- Building code enforcement.
- Architects, building designers, engineers, developers, builders, contractors.
- Regulators – State Construction Office, State Energy Office, Office of State Budget and Management.

Implementation Mechanisms

Potential implementation mechanisms and supporting activities for this mitigation option include:

- Performance-based Contracting (PC) for funding of energy efficiency improvements - Capital costs paid back through energy savings. Should the PC reach a payback period threshold in perhaps 12 or 15 years, or mandate PC contain a renewable energy component then funds are paid back.
- Create a Clearinghouse for information on and access to software tools to calculate impact of energy efficiency and renewable technologies for buildings.
- Energy technologies that should be promoted by this section include but are not limited to:
 - Active and passive solar building technologies such as photovoltaic panels, solar hot water heaters, and solar-powered (absorption) air conditioning.
 - Support for new-to-market technologies, such as Solar Hybrid Lighting (using light guides to bring daylight into building interiors), where appropriate in select, potentially high profile, researched and monitored projects for future broad application.
 - Ground-source Heat Pumps.
 - Focus on specific end uses/technologies such as lighting, water heating, plug loads, networked computer management, power supplies, motors, pumps, boilers, cool roofing, etc.
- Carry out a comprehensive statewide survey of energy and water efficiency features in existing government buildings to provide information on the potential for energy efficiency in the NC government building stock.

Related Policies/Programs in Place

- At the 5/23 CAPAG meeting, the Environments for Living program²² was noted as an example, with builders having built 80,000 homes in the South and Southwest under the

²² See <http://www.eflhome.com/>.

program in the last five years. Also, it was noted that solar water heating is included in the NC Green Power Program.

- The NC HealthyBuilt Homes (HBH) program, supported in part by the NC State Energy Office, has been very active in the State.
- ENERGY STAR Homes is another example of building performance standards and certifications in use in North Carolina.
- The State Energy Office is involved in federal Industries of the Future. CSA recommendation A-5: “Promote and Support Efforts to Establish North Carolina as a World Leader in GHG, Non- Carbon Fuels and Energy Efficiency Technologies.”
- **SEP Exec-11:** Reduction of energy consumption in State agencies and universities.
- **SEP Exec-15:** The General Assembly should review options, such as a Public Benefits Fund (PBF) or other means, to enable funding of the recommendations in the State Energy Plan.
- **SEP Exec-20:** The State Energy Office should organize a statewide effort to develop criteria for a residential high performance building program to reduce the life cycle cost of new and existing buildings.
- **SEP 6-1:** Development of a Solar Schools Program.
- **SEP 7-1:** North Carolina statutes should require that designers of all new public buildings provide estimates of projected energy consumption and energy costs for the building prior to construction.
- **SEP 7-3:** Implementation of high performance building guidelines developed for North Carolina in all new public buildings and for new public housing.
- **SEP 7-7:** Local governments should be encouraged to implement SEP recommendations and other energy efficiency programs.
- **SEP 8-3:** The State Energy Office should encourage new manufactured homes to comply with the critical components of the state energy code for site-built residential units and promote ENERGY STAR manufactured homes.
- **SEP 9-4:** The State Energy Office should promote the use of and provide training for commercial building energy analysis software.

Types(s) of GHG Reductions

As with RCI-1 and RCI-2, this option would principally yield reductions in GHG emissions (largely CO₂) from avoided electricity production and avoided on-site fuel combustion. Less significant are the reduction in CH₄ emissions from avoided fuel combustion and avoided pipeline leakage. Other GHG impacts are also conceivable, but are likely to be small (black carbon, N₂O) and/or very difficult to estimate (materials use, life cycle, market leakage, etc.).

Estimated GHG Reductions and Costs (or Cost Savings)

Energy Efficiency Requirements for Government Buildings	2010	2020	Units
GHG Emission Savings	0.0	1.1	MMtCO ₂ e
Net Present Value (2007-2020)		-\$88	\$ million
Cumulative Emissions Reductions (2007-2020)		6.4	MMtCO ₂ e
Cost-Effectiveness		-\$14	\$/tCO ₂ e

Data Sources: Costs of energy efficiency improvements based on studies of costs of building improvements and code changes.

Quantification Methods: Estimates fractional savings in energy intensities needed, after code improvements, in new and existing government buildings. Allocates intensity savings among energy efficiency, renewable energy sources.

Key Assumptions: Fractions of electric and gas intensity improvement accounted for by efficiency improvements, solar thermal, solar PV, and/or increased biomass use; fractional savings target of 20% over new code levels.

Key Uncertainties

- Total government building space in North Carolina (regional estimates currently used with state building floor area data to estimate total government building floorspace—state, local, county, and schools).²³
- Fraction of government agencies occupying leased space in North Carolina (estimate of 10 percent of government-owned building space used).
- Rate of building renovations versus new construction in the government sector (estimate of 30 percent used based on consideration several national and regional sources).

Additional Benefits and Costs

Benefits

Co-benefits could include transmission/distribution system costs reduction.

Costs

None Cited.

Feasibility Issues

- Costs for this option are uncertain, depending on the measures included.
- Potential interaction with appliance standards and utility programs.

²³ Data compiled from NC State Property Office indicates total gross floor area of state-owned buildings in North Carolina of approximately 106 million square feet as of 2006. Summary data provided by Len Hoey of the NC State Energy Office.

Status of Group Approval

Completed.

Level of Group Support

Unanimous Consent.

Barriers to Consensus

None.

RCI-4 Market Transformation and Technology Development Programs

Mitigation Option Description

A market transformation program is designed to create a situation where the bulk of the private market automatically adopts or incorporates technologies or techniques that result in improved energy efficiency. The goal of a market transformation and technology development program is to put energy efficiency technologies and practices into a position where they will be demanded by the public and chosen by builders and manufacturers. Methods of transformation will be different for each technology or technique, but often revolve around public and private review of quality and effectiveness, including partnerships between government agencies, retailers, manufacturers, and non-governmental agencies.

Mitigation Option Design

The intent of a market transformation program is to ensure that voluntary standards are rigorous enough to set a high bar while being understandable and valuable to the buyer. Market transformation efforts also often go hand-in-hand with technology development efforts.

A market transformation and technology development program must be long-term and robust. There must be CONSISTENT and enduring support for technology improvement and incorporation. There must be continued investment in technology development and integration. There must be independent evaluation of the efficacy of the technologies.

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

- Promote the appropriate use of NEMA Premium motors and drives in industrial applications.
- Provide 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.
- Promote the use of ground-source heat pumps by helping to identify and qualify appropriate applications.
- Encourage increased funding for ENERGY STAR to identify and qualify a greater number of products under their labeling.
- Encourage and enable smaller purchasers to act in aggregate groups to reduce costs and quantify emission reduction benefits from technology and process improvements.

- Provide a continuous funding level for near-term research and deployment of energy efficient technologies and processes.

Goals: Because this recommendation involves policy process rather than a specific emissions reduction technology, the goals will be different and dependent on the selected technologies included in the programs. A goal of any policy in this area is to provide consistent support with the end-result being a time when the support can be removed without the program benefits ending as well. Thus, the goal is to permanently transform markets to increase and accelerate the uptake of products with higher energy efficiency and of renewable energy products, working through a regional alliance that achieves savings similar to those achieved in other regions of the United States.

Timing: This policy recommendation requires consistent and long-term thinking. Successful examples of transformation programs in other areas of the country were years and decades in the making. Set up agency/agencies in 2010. Start activities in 2012.

Parties Involved: All sectors and stakeholders in the state may be involved in market transformation programs, including:

- Retailers.
- Utilities.
- Manufacturers.
- Non-profit consortia.
- Consumers association.
- Professional Associations (engineers, builders, architects, designers).
- State agencies.

Implementation Mechanisms

Implementation of market transformation programs requires the participation and buy-in of industry partners, regulatory bodies and consumer groups. Potential implementation mechanisms and supporting activities for this mitigation option include:

- Collaborative marketing of energy efficiency and renewable energy technologies.
- Specific implementation measures mentioned as possible for this option include; tax credits, low/no interest loans, and similar financial incentives to business, industries and commercial firms to upgrade their equipment (including manufacturing and pollution control equipment) to more energy efficient technologies. The latter approach is especially important for small manufacturers, and can mean access to micro-loans.
- Funding of Research and Development for Energy Efficiency, Renewable Energy, other GHG Reduction Strategies.
- Could include patent protection, R&D tax credits, production subsidies or tax credits to firms bringing new technologies to market, tax credits or rebates for new technology buyers, government procurement, and demonstration projects.

- Market transformation is an area where the State Energy Office might be funded to contribute.

Related Policies/Programs in Place

- There are several related programs in place that can be modeled for other technologies and processes. One such program is run by the North Carolina Housing Finance Agency (NCHFA). The NCHFA provides training to their non-profit builders such as Habitat for Humanity affiliates. Further, the NCHFA provides a program where organizations may receive funds to participate in an energy guarantee program for new homes, if the homes are tested and achieve certain performance levels. More than 1,000 homes in NC are part of this program, which is now being replicated in other states.
- **SEO CONTRACT Appalachian State University Energy Center.**
- A program exists in NC to dispose of a refrigerator for free.
- **SEP Exec-1:** The North Carolina Department of Commerce and the State Energy Office should encourage and support economic development of energy-related enterprises whose products are intended to increase energy efficiency or use renewable resources.
- In 1980 the North Carolina Utility Commission (NCUC) established a systems benefit charge, creating a non-profit corporate to administer the funds with the charter “to encourage energy efficient economic development in North Carolina.” The non-profit Advanced Energy operates programs for subsidized and market-rate home construction, and provides energy efficiency assistance to North Carolina industry.²⁴
- State Energy Office is involved in federal Industries of the Future. CSA recommendation A-5: *Promote and Support Efforts to Establish North Carolina as a World Leader in GHG, Non- Carbon Fuels and Energy Efficiency Technologies*. SEP recommends further incentives for high efficiency motors.
- **SEO CONTRACT PEM Fuel Cell.**
- **SEO CONTRACT Landfill Gas Conference.**
- Energy Improvement Loan Program.
- NC Weatherization Assistance Program, for low income earners; SEP recommends extending weatherization.

Types(s) of GHG Reductions

GHG impacts are similar in nature to those noted for RCI-1 through RCI-3 above.

²⁴ See <http://www.advancedenergy.org/>.

Estimated GHG Reductions and Costs (or Cost Savings)

Energy Efficiency Requirements for Government Buildings	2010	2020	Units
GHG Emission Savings	0.0	2.0	MMtCO ₂ e
Net Present Value (2007-2020)		-\$339	\$ million
Cumulative Emissions Reductions (2007-2020)		10.5	MMtCO ₂ e
Cost-Effectiveness		-\$32	\$/tCO ₂ e

Data Sources: Market transformation program costs and performance based on programs and experience of the Northwest Energy Efficiency Alliance.

Quantification Methods: Apply program results in percent savings, from other regions, to North Carolina.

Key Assumptions:

- Market transformation programs can reduce electricity demand by 0.2% annually.
- The implementation must be timed correctly.

Key Uncertainties

It is unknown the degree to which other states in the region will join with North Carolina to increase program effectiveness.

Additional Benefits and Costs

Benefits

- The non-energy and non-emission benefits are almost always going to be the economic drivers behind the success of these programs. Focusing only on emission reductions or only on payback through energy efficiency of the user will eliminate many technologies when they could otherwise provide substantial economic benefits. An example is an improvement to an industrial production line that may have negligible overall energy consumption reduction at the plant, but that decreases the energy consumption per unit produced (energy intensity) while speeding up production and retaining jobs in the state.
- Co-benefits could include transmission/distribution system costs reduction.
- Programs could help to lower capital and installation costs.

Costs

None Cited.

Feasibility Issues

Interaction with appliance standards and utility programs.

Status of Group Approval

Completed.

Level of Group Support

Unanimous Consent.

Barriers to Consensus

None.

RCI-5 Improved Appliance and Equipment Efficiency Standards

Mitigation Option Description

Appliance efficiency standards reduce the market cost of energy efficiency improvements by incorporating technological advances into base appliance models, thereby creating economies of scale. Appliance efficiency standards can be implemented at the state level for appliances not covered by federal standards, or standards can be jointly developed by multiple states.

Mitigation Option Design

This mitigation option involves the replication of standards adopted in other states for appliances not covered by federal standards. It also involves the State, working together with other states in the region, advocating for stronger federal appliance efficiency standards where this is technically feasible and economically justified. Of these options for coverage, implementation of stronger-than-federal standards together with other states, including states in the Southeast region, 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.

Elements of this option design include:

- Development of committee or other working group to develop recommendations on appliance standards (similar to existing group for building codes).
- Adoption of State-level Appliance Efficiency Standards, defined sufficiently broad enough to include, for example, commercial sector, and information technology (IT) equipment.
- North Carolina voices support for adoption of more stringent federal-level appliance efficiency standards.
- Design a standard for recycling of materials in appliances.
- Include water use reduction as a criterion for appliance efficiency improvement.

Goals: Increase stringency of appliance standards to the level of those recommended by the Appliance Standards Awareness Program.²⁵

Timing: Adopt new standards by 2010. Standards in force by 2012.

Parties Involved: State agencies to enforce state codes and standards.

²⁵ See www.standardsasap.org. The analysis recommends standards for the following products: bottle-type water dispensers, commercial boilers, commercial hot food holding containers, compact audio products, DVD players and recorders, liquid immersion distribution transformers, medium voltage dry-type distribution transformers, metal halide lamp fixtures, pool heaters, portable electric spas, residential furnaces and boilers, residential pool pumps, single voltage external AC to DC power supplies, state regulated incandescent reflector lamps, walk-in refrigerators and freezers.

Implementation Mechanisms

Potential implementation mechanisms and supporting activities for this mitigation option include:

- Appliance Standards promulgated by legislation or developed administratively.
- 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.
- Elevated energy standards for appliances and equipment purchased by public agencies.
- Work with manufacturers and consider impacts on manufacturers when setting new standards.

Related Policies/Programs in Place

- State Energy Plan (SEP) recommends ENERGY STAR from 2008 on
 - The state is an ENERGY STAR Partner
- Existing Federal Appliance Efficiency Standards (2005 Energy Bill).
- **SEP 7-6:** North Carolina Department of Administration should require that all state facilities with motors larger than 5 horsepower must develop a motor maintenance program.
- **SEP 10-3:** North Carolina should evaluate whether facilities that repair or rewind motors should be certified or otherwise meet a state efficiency requirement.
- **SEP 10-5:** North Carolina should create investment tax credits and other incentives for new and/or retrofitted manufacturing equipment to encourage modernization and efficiency improvements.
- **SEP 10-9:** The State Energy Office should sponsor workshops on industrial energy efficiency around the state directed at industrial facility operators, design and process engineers, and owners.

Types(s) of GHG Reductions

GHG impacts are similar in nature to those noted for RCI-1 through RCI-3 above.

Estimated GHG Reductions and Costs (or Cost Savings)

Improved Appliance and Equipment Efficiency Standards	2010	2020	Units
GHG Emission Savings	0.0	1.0	MMtCO ₂ e
Net Present Value (2007-2020)		-\$336	\$ million
Cumulative Emissions Reductions (2007-2020)		5.3	MMtCO ₂ e
Cost-Effectiveness		-\$63	\$/tCO ₂ e

Data Sources: Fractional savings and costs drawn from ASAP and ACEEE, 2006. "Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards."

Quantification Methods: Results for North Carolina from report above adapted by adjusting for different analysis period, discount rate, and energy prices.

Key Assumptions: Costs and savings from efficiency improvement via standards will be similar in North Carolina to those indicated in the ASAP/ACEEE report.

Key Uncertainties

It is unknown the degree to which other states in the region will join with North Carolina in setting higher-than-federal standards so as to increase effectiveness and practical application of standards.

Additional Benefits and Costs

Benefits

Reduction in water use for some appliance upgrades.

Costs

None Cited.

Feasibility Issues

Feasibility enhanced by ongoing efforts in nearby states.

Status of Group Approval

Completed.

Level of Group Support

Unanimous Consent.

Barriers to Consensus

None.

RCI-6 Building Energy Codes

Mitigation Option Description

Building energy codes specify minimum energy efficiency requirements for new buildings or for existing buildings undergoing a major renovation. As energy use in buildings in North Carolina accounts for about one-third of North Carolina's current gross GHG emissions, amending State and/or Local 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.

Mitigation Option Design

North Carolina has building energy codes modeled on the International Energy Conservation Code 2000 for residential and commercial buildings, and enforced by the Building Code Council. An ongoing process of code amendments for new and renovated residential and commercial buildings is proposed as follows.

- North Carolina should adopt more stringent building codes to improve the efficiency of energy use in buildings. North Carolina can use cost-effectiveness tests to identify where moving beyond national building codes makes economic sense. Also, the state can make improvements in codes including but not limited to HVAC²⁶ systems, daylighting design to reduce lighting needs, electric lighting design, building envelope design, and using integrated building design strategies.
- 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. A three-year cycle 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 education for building inspectors and other building industry professionals to assure that the new codes are implemented and enforced.

²⁶ Heating, Ventilation, and Air Conditioning

Goals:

- Enforce existing building energy codes by 2008.
- Establish a new energy code by 2010 that requires new NC residences and commercial/industrial buildings to be 20% more efficient than buildings meeting current national building energy codes, and assure that the new code is enforced.

Timing: Updated every 6 months when the national energy code changes.

Parties Involved:

- North Carolina Department of Insurance, who can implement new codes.
- State and Local government building code enforcement agencies.
- Mobile Home Manufacturing Industry and Building Industry Associations in discussion of this issue.

Implementation Mechanisms

Potential implementation mechanisms and supporting activities for this mitigation option include:

- Coordination with consumer products programs, possibly including incentives, retailer training, marketing and promotion, education, etc.
- Develop Training and Education programs for:
 - Builders and Contractors (such as related to HVAC sizing, duct sealing, energy analysis program, C&D waste recycling, renewable energy system installation, water distribution systems).
 - Trade School and Community College Students (for example, including the skills noted above skills in curricula).
 - Building Code and other Officials in Energy Code Enforcement.
- Develop a clearinghouse for information on and access to software tools to calculate the impacts of energy efficiency and solar technologies for buildings.

Related Policies/Programs in Place

- NC has building energy codes modeled on IEC 2000 for residential and commercial and enforced by Building Code Council; SEP R-4 recommends reviewing compliance and potential improvement. Analyses of building code improvements have been undertaken by Jeff Tiller at ASU. Building codes are enforced by the Building Code Council and the North Carolina Department of Insurance.
- Latest information on Department of Insurance web site indicates ASHRAE 90.1 2004.
- Advanced Energy Corporation, NC Solar Center, and others have ongoing programs in this and similar areas.
- Training of Building Code and other Officials in Energy Code Enforcement (Recommended in State Energy Plan).

- Advanced Energy Corporation is currently reviewing nine calculators for assessing building energy efficiency and solar technologies for buildings. Availability of tools could be widened.
- In 1980 the North Carolina Utility Commission (NCUC) established a systems benefit charge, creating a non-profit corporation to administer the funds with the charter “to encourage energy efficient economic development in North Carolina.” The non-profit Advanced Energy operates programs for subsidized and market-rate home construction, and provides energy efficiency assistance to North Carolina industry.²⁷
- State Energy Office is involved in federal Industries of the Future. CSA recommendation A-5: *Promote and Support Efforts to Establish North Carolina as a World Leader in GHG, Non- Carbon Fuels and Energy Efficiency Technologies*, SEP recommends further incentives for high efficiency motors.
- NC Weatherization Assistance Program, for low income earners SEP recommends extending weatherization.
- **SEP Exec-14:** The State Energy Office should develop programs, in addition to weatherization, to address energy-efficient housing in the low-income sector.
- **SEP Exec-20:** The State Energy Office should organize a statewide effort to develop criteria for a residential high performance building program to reduce the life cycle cost of new and existing buildings.
- **SEP 7-1:** North Carolina statutes should require that designers of all new public buildings provide estimates of projected energy consumption and energy costs for the building prior to construction.
- **SEP 7-3:** The North Carolina Department of Administration should implement high performance building guidelines developed for North Carolina in all new public buildings and new public housing.
- **SEP 8-1:** The State Energy Office should conduct a study on current compliance levels of residential and commercial buildings with the North Carolina state energy code.
- **SEP 8-2:** The State Energy Office should create an Energy Code Enforcement Assistance Program to provide additional energy code enforcement and outreach officials to serve across the state.
- **SEP 8-3:** The State Energy Office should encourage new manufactured homes to comply with the critical components of the state energy code for site-built residential units and promote ENERGY STAR manufactured homes.
- **SEP 8-7:** The State Energy Office should provide training on high performance buildings to building professionals in a number of different classifications.
- **SEP 9-1:** The State Energy Office should work with appropriate state agencies to provide a design review service that focuses on energy-efficient components and holistic, high-performance, design strategies for new commercial buildings.

²⁷ See <http://www.advancedenergy.org/> (6.9).

- **SEP 9-4:** The State Energy Office should promote the use of and provide training for commercial building energy analysis software.
- Integration with Regional Demand Response Initiatives/recommendations is a SEP recommendation.

Types(s) of GHG Reductions

- CO₂ reduction from avoided electricity production and avoided on-site fuel combustion.
- Modest reduction in CH₄ emissions from avoided fuel combustion and avoided natural gas pipeline leakage, relatively small reductions in N₂O, Black Carbon emissions from avoided fuel consumption.

Estimated GHG Reductions and Costs (or Cost Savings)

Building Energy Codes	2010	2020	Units
GHG Emission Savings	0.5	3.5	MMtCO ₂ e
Net Present Value (2007-2020)		-\$400	\$ million
Cumulative Emissions Reductions (2007-2020)		23.1	MMtCO ₂ e
Cost-Effectiveness		-\$17	\$/tCO ₂ e

Data Sources: Building Code Assistance Project (BCAP) analyses by state (including North Carolina) to derive base savings.

Quantification Methods: Apply general BCAP method to estimate code savings, but apply 20% target savings figure.

Key Assumptions: Average costs of building code improvements, ratio of gas improvements to electricity improvements.

Key Uncertainties

It is unknown, if renovations will be included in building energy code requirements. In addition, data on the annual amount of commercial and residential renovated floorspace were not found, so an estimate of 0.3 units of renovated commercial floorspace per unit new commercial floorspace (based on national and regional estimates) was used, and renovated residential floorspace was not considered in the analysis.

Additional Benefits and Costs

Benefits

Potential to also yield water savings, comfort/air quality improvements.

Costs

None Cited.

Feasibility Issues

Interaction with appliance standards and utility programs.

Status of Group Approval

Completed.

Level of Group Support

Unanimous Consent

Barriers to Consensus

None.

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

Mitigation Option Description

Energy use in existing buildings and in non-government-funded new buildings must be substantially improved. This mitigation option provides incentives and targets 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.

Mitigation Option Design

Elements of this Option Design include:

- Promotion and Incentives for “beyond code” construction, using programs of various types for various sectors:
 - It is important to focus programs for building energy efficiency and renewable, clean, safe energy on specific market segments such as existing residential construction (weatherization), new home construction, apartments, low income housing, commercial new construction, commercial renovation construction, and others.
 - Improved design and construction standards and guidelines addressing multiple aspects of resource conservation, with a focus on energy. Examples of such standards include the following:
 - LEED (Leadership in Energy and Environmental Design, a national building certification program) which is currently mature in the commercial building arena but which includes fairly minimal energy requirements in its current version. The newer “LEED plus Massachusetts” standard includes more explicit energy efficiency requirements.
 - NC HealthyBuilt Homes, a statewide residential green building certification program with ENERGY STAR as the energy efficiency base and additional energy requirements for the building envelope/comfort systems/appliances, lighting, and use of renewable energy. This includes IAQ requirements to ensure that EE does not jeopardize human health.
 - ENERGY STAR Homes (a standard focused on energy efficiency for the building envelope and comfort systems).

- Environments for Living (a national residential energy efficiency certification program focused on large builders with some indoor air quality features).
- Energy technologies that should be promoted by this section include but are not limited to: active and passive solar building technologies, photovoltaic Panels on new commercial buildings and many new homes, solar hot water heaters on homes and other buildings²⁸, new and existing building energy technologies, such as Solar Hybrid Lighting, where appropriate, particularly in select, potentially high profile, researched and monitored projects for future broad application, solar-powered (absorption) air conditioning for residential and commercial applications, ground-source heat pumps, high-efficiency boilers, and cool roofing.
- Energy education should be promoted under this option in coordination with the programs noted in RCI-8. (See Implementation Mechanisms, below.)

Goals:

- **Incentives** 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 (that meets the upgraded building code) by 30%. These numbers will, on average, decrease energy use by 30% across the board above the existing building code requirements and encourage significant examples throughout the state of various building types that use 50% or less energy than is supported by the existing building code.²⁹
- Incentives are provided to upgrade 20% of existing buildings by 2015 as follows:
 - Residential building energy performance improvements must increase by 15%.
 - Commercial building energy performance improvements must increase by 20%. This increase in efficiency should bring 20% of existing buildings up to the standard of the 2003 IECC (the current NC code, not the improved codes) .

Timing: Ramp up program starting in 2007 to full effectiveness by 2012, except where noted otherwise.

Parties Involved:

- State governments, local governments and other public entities (leading by example, largely via RCI-3).
- Building code enforcement.

²⁸ Note that the inclusion of solar technologies here may overlap with programs recommended under other RCI options.

²⁹ It should be noted that a 30% reduction is cost-effective given basic improvements in design, materials and equipment but a 50% reduction in energy use requires a much heavier investment cost and will often require the use of renewable energy strategies (depending on building orientation, placement or exposure). This effort is focused on supporting and growing the market of building professionals in our state who can perform this work for three reasons in addition to decreasing greenhouse gas emissions: 1) increase availability of capable building professionals for consumers wishing to increase energy performance 2) increase market competition in energy performance improvements 3) provide a base for energy security as energy resources become more expensive and/or scarce.

- Architects, building designers, engineers, developers, builders, contractors.
- Retailers of energy-efficient products.
- Manufacturers of alternative building products.

Implementation Mechanisms

Potential implementation mechanisms and supporting activities for this mitigation option include:

- Performance-based contracting for funding of energy efficiency improvements, with capital costs paid back through energy savings.
- The CAPAG recommends that the TWG suggest potential sources of funds to provide incentives for “green building” design and implementation.
- Streamlined application procedures for green building-related improvements.
- Comprehensive state survey of energy and water efficiency features in existing residential and commercial buildings to provide information on the potential for energy efficiency in NC buildings.
- Implementation of a Clearinghouse for information on and access to software tools to calculate impact of energy efficiency and solar technologies for buildings.
- Energy benchmarking, measurement, and tracking programs for privately-owned buildings.
- Energy education that should be promoted under this option, in coordination with the programs noted in RCI-8 and including but not limited to:
 - Training and Education for Building Construction Phase Professionals (e.g. HVAC sizing, duct sealing, energy analysis program, C&D waste recycling, renewable energy system installation, water distribution systems).
 - Support for growth and health of the residential building performance specialist industry.
 - Continuing Education for Building Design Phase Professionals, including architects, engineers, developers, contractors, urban planners, and realtors.
 - Energy efficiency, renewables and related education introduced at community colleges and trade schools.
- Building codes could include a recommendation that existing homes and commercial buildings at resale are upgraded to meet an energy efficiency standard, and financing programs be provided to help with the costs of those upgrades. If implemented, such a recommendation could be formulated so that only cost-effective savings would be included, and coordinated with lender and education consumer programs to spur the offering of “green mortgages” for qualifying properties, and to demonstrate overall lower ongoing cost-of-ownership for upgraded buildings.

Related Policies/Programs in Place

- The Energy Independence Act, S2051 filed May 2006, requires facility projects that receive state funding to reduce energy purchases by 20% by 2015.
- NC Green Building Technology database provides searchable database on case studies.
- S2001, H1272 required state government to review the use of High Performance Building guidelines in 7 buildings.
- Examples of existing programs: NC Healthy Built Homes, Healthy Building Resource Center Environments for Living in addition to those listed, groups offering programs and other services related to building energy efficiency and related programs include CERT at NCA&T, Appalachian State, Southern Research Institute, RTI, and others.
- SEP recommends:
 - ENERGY STAR home requirements by county.
 - Energy efficient mortgages.
 - Develop further programs to support privately funded projects.
 - Require high performance building standards for permits to build privately funded school projects.
- Advanced Energy Corporation and NC Solar Center, and others have ongoing programs in this and similar areas.
- Advanced Energy Corporation is currently reviewing nine calculators for assessing building energy efficiency and solar technologies for buildings. Availability of tools could be widened.
- At the 5/23CAPAG meeting, the Environments for Living program³⁰ was noted as an example, with builders having built 80,000 homes in the South and Southwest under the program in the last five years. Also, it was noted that solar water heating is included in the NC Green Power Program.
- In 1980 the North Carolina Utility Commission (NCUC) established a systems benefit charge, creating a non-profit corporate to administer the funds with the charter “to encourage energy efficient economic development in North Carolina.” The non-profit Advanced Energy operates programs for subsidized and market-rate home construction, and provides energy efficiency assistance to North Carolina industry.³¹
- State Energy Office is involved in federal Industries of the Future. CSA recommendation A-5: “Promote and Support Efforts to Establish North Carolina as a World Leader in GHG, Non- Carbon Fuels and Energy Efficiency Technologies”. SEP recommends further incentives for high efficiency motors.

³⁰ See <http://www.eflhome.com/>.

³¹ See <http://www.advancedenergy.org/>.

- SEP recommends state procurement of environmentally preferable products.
- NC Weatherization Assistance Program, for low income earners SEP recommends extending weatherization.
- Extend green campus initiatives to all university Buildings is a SEP recommendation.
- Energy benchmarking, measurement, and tracking programs for municipal and state buildings is a SEP recommendation.
- **SEO CONTRACT, The Center for Energy Research and Technology.**
- **SEP Exec-20 (formerly 8-4):** The State Energy Office should organize a statewide effort to develop criteria for a residential high performance building program to reduce the life cycle cost of new and existing buildings.
- **SEP 7-3:** The North Carolina Department of Administration should implement high performance building guidelines developed for North Carolina in all new public buildings and for new public housing.
- **SEP 8-3:** At a minimum, the State Energy Office should encourage new manufactured homes to comply with the critical components of the state energy code for site-built residential units and promote ENERGY STAR manufactured homes.
- **SEP 8-5:** The State Energy Office should develop a comprehensive, statewide promotional campaign for high performance buildings.
- **SEP 8-6:** The State Energy Office should continue its work to formulate and advance mortgage-based incentives for high performance new homes.
- **SEP 8-7:** The State Energy Office should provide training on high performance buildings to building professionals in a number of different classifications.
- **SEP 8-8:** The State Energy Office should provide training for building professionals on specific targeted technologies including residential daylighting, solar water heating, heat pump water heaters, new insulation products, and advanced HVAC systems and controls.
- **SEP 9-1:** The State Energy Office should work with appropriate state agencies to provide a design review service that focuses on energy-efficient components and holistic, high-performance, design strategies for new commercial buildings.

Types(s) of GHG Reductions

- CO₂ reduction from avoided electricity production and avoided on-site fuel combustion.
- Modest reduction in CH₄ emissions from avoided fuel combustion and avoided natural gas pipeline leakage, relatively small reductions in N₂O, Black Carbon emissions from avoided fuel consumption.

Estimated GHG Reductions and Costs (or Cost Savings)

“Beyond Code” Building Design Incentives and Targets, Incorporating Local Building Materials and Advanced Construction	2010	2020	Units
GHG Emission Savings	0.7	5.2	MMtCO ₂ e
Net Present Value (2007-2020)		-\$494	\$ million
Cumulative Emissions Reductions (2007-2020)		34.2	MMtCO ₂ e
Cost-Effectiveness		-\$14	\$/tCO ₂ e

Data Sources: Costs of energy efficiency improvements based on studies of costs of building improvements and code changes.

Quantification Methods: Estimates fractional savings in energy intensities needed to meet targets in new commercial and residential buildings. Allocates intensity savings among energy efficiency, renewable energy sources.

Key Assumptions: Fractions of electric and gas intensity improvement accounted for by efficiency improvements, solar thermal, solar PV, and/or increased biomass use; fractional savings targets over (new) code levels; growth in housing stock.

Key Uncertainties

- Total commercial building space in North Carolina (regional estimates currently being used).
- Total renovated commercial space included in option per unit new commercial space (current estimate used is 0.3, based on regional and national studies).
- Fractions of new commercial buildings, and residential units, participating in program.

Additional Benefits and Costs

Benefits

Potential to also yield water savings, comfort/air quality improvements.

Costs

None Cited.

Feasibility Issues

Interaction with appliance standards and utility programs.

Status of Group Approval

Completed.

Level of Group Support

Unanimous Consent.

Barriers to Consensus

Not Applicable

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

Mitigation Option Description

This mitigation option reflects the realization 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. In addition, in order to effectively implement many of the other RCI options above, specific and targeted education, 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.

Mitigation Option Design

Elements of this Option Design include:

- Training and education for builders and contractors (such as in HVAC sizing, duct sealing, building energy analysis, waste recycling, renewable energy system installation, and water distribution systems).
- Training of building code and other officials in energy code enforcement.
- Energy Management Training/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 programs (probable overlap with recommendations of Cross-Cutting TWG).
- Continued funding to meet the expanding role of State Energy Office as a key consumer information outlet.
- Emphasize provision of resources directing consumers to information and technologies for energy-efficiency and climate impacts reduction.
- Introduce in School Curriculum (probable overlap with recommendations of Cross-Cutting TWG).

Goals: Implement training and education as described above in support of other RCI options. The CAPAG recommends that the TWG consider some more quantitative goals for this option, such as number of persons trained in a given area. For example, NC can quantify the information

by identifying the number of trade professionals who go through a training program each year, use the number of credits/courses offered, the number of students reached or the fractions of applicants receiving specific types of training.

Timing: Education/Training option X in place by 20YY to coincide with need to support Option Z.

Parties Involved:

- Code enforcement agencies.
- Building professional trade groups.
- Community colleges.
- Universities.
- Primary/Secondary Schools.
- Public Information Agencies.

Implementation Mechanisms

Potential implementation mechanisms and supporting activities for this mitigation option include:

- Include coverage of energy efficiency topics in the exam for general contractors.
- Include coverage of energy efficiency topics in continuing education and recertification course and exams for public school teachers.

Related Policies/Programs in Place

- Advanced Energy Corporation and NC Solar Center, and others have ongoing programs to train and educate builders and contractors and offer training in similar areas.
- Training of building code and other officials is recommended in State Energy Plan.
- SEP recommends training programs for state building operators and for private building operators.
- CSA Recommendation A-7: “Public Education on Climate Change”.
- NC Air Aware provides info for teachers, focus on ozone.³²
- **SEO CONTRACT Energy Management Diploma.**
- **SEO CONTRACT Consumer Energy Education Program.**
- **SEO CONTRACT Building Operator Certification.**
- **SEO CONTRACT National Energy Education Development.**
- **SEO CONTRACT, Sustainable Design Competition.**
- **SEO CONTRACT, RFP for Utility Accounting Services.**
- **SEO CONTRACT, State Energy Office Information and Referral Center.**

³² See <http://daq.state.nc.us/airaware/>.

- **SEP 6-1:** Development of a Solar Schools Program.
- **SEP 6-2:** The State Energy Office can work with the state's professional licensing boards to develop a certification program for renewable energy installers.
- **SEP 8-7:** The State Energy Office can provide training on high performance buildings to building professionals in a number of different classifications.
- **SEP 8-8:** The State Energy Office can provide training for building professionals on specific targeted technologies including residential daylighting, solar water heating, heat pump water heaters, new insulation products, and advanced HVAC systems and controls.
- **SEP 9-4:** The State Energy Office can promote the use of and provide training for commercial building energy analysis.
- **SEP 10-9:** The State Energy Office can sponsor workshops on industrial energy efficiency around the state directed at industrial facility operators, design and process engineers, and owners.
- **SEP 12-1:** Develop and sponsor training programs for community colleges and universities in fields related to energy efficiency and high performance buildings.
- **SEP 12-2:** Assist in the coordination of energy education programs with museums and help create an energy museum "on wheels" using existing resources, such as the Science House at NCSU or the Museum of Life Science, wherever possible.
- **SEP 12-3:** Sponsor regional "renewable demonstration centers" or, whenever possible, use existing ones e.g., demonstration centers such as the North Carolina Solar House and the EnergyXchange, museums such as the Museum of Life and Science, and Discovery Place.
- **SEP 12-4:** Create energy internships or apprenticeships for graduating college students and high school students to create the next generation of energy professionals.
- **SEP 12-5:** Provide a statewide award e.g., a college scholarship for the most outstanding energy-related science demonstration or experiment at the state science fair.
- **SEP 12-6:** Help the Education Departments of colleges and universities develop coursework for junior and senior undergraduates and graduate students in energy education.
- **SEP 12-7:** Help Community Colleges and other vocational schools develop coursework in energy efficiency and renewable energy to help spur the industry; such as training carpentry students in energy efficient, passive solar building design and construction. Include this training in voc-tech courses in high schools.
- **SEP 12-8:** Provide training to licensed professionals in the homebuilding industry focusing on energy efficiency and renewable energy sources to promote industry awareness and implementation of these technologies.
- **SEP 12-9:** Support development of a comprehensive information outreach program for consumer questions about saving energy and using renewables in their homes and businesses.

- **SEP 12-10:** North Carolina should encourage schools to reduce school operating budgets by installing energy efficiency and renewable energy systems.
- **SEP 12-12:** The State Energy Office should work in partnership with the State Department of Public Instruction to plan school energy-related initiatives and include a representative for energy-use in school facilities on the Energy Policy Council.
- **SEP 12-15:** The North Carolina Community College System should require that the community colleges' curricula provide a building science course, an energy design course for drafting programs, and a solar and or renewable energy technology class.
- **SEP 12-14:** Sponsor a program to install solar equipment or other sustainable energy technologies on school buildings in every school district in the state.
- **SEP 12-16:** Establish a central repository for energy information.

Types(s) of GHG Reductions

These education and information programs are crucial in enabling and supporting GHG emissions reductions in a number of RCI areas, but their direct GHG reduction impacts are very difficult to assess.

Estimated GHG Reductions and Costs (or Cost Savings)

As this education option is primarily in support of many other options in the RCI and other sectors, quantitative savings and costs results are not evaluated here.

Key Uncertainties

Not directly applicable.

Additional Benefits and Costs

Benefits

None Cited.

Costs

None Cited.

Feasibility Issues

Potential contribution of consumer education programs to reducing GHG emissions is difficult to estimate.

Status of Group Approval

Completed.

Level of Group Support

Unanimous Consent.

Barriers to Consensus

None.

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

Mitigation Option Description

“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. Also included in this option is 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.

Green power differs from a Renewable Portfolio Standard (RPS) in that the RPS requires that electric utilities provide a certain level of renewable energy in their generation mix, while green power allows consumers to set the level of renewable energy used to provide the electricity they consume.

Mitigation Option Design

It is recommended 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.

NC GreenPower is an existing program that accepts financial contributions from North Carolina citizens and businesses to help offset the cost to produce green power. There are several options that can be implemented that would greatly increase the scope and effectiveness of the program.³³ A number of suggestions designed to mandate the use of green power in state buildings, and to encourage the development of both demand for and supply of green power in the private sector, are provided under “implementation measures”, below.

Goals: 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 goal would be phased in starting in 2008.

Note to TWG: At its meeting of 5/8/07, the CAPAG offered no objections to the design or goals of this option, but significant discussion took place among CAPAG members concerning whether North Carolina’s renewable resources would be sufficient to support this option plus the other renewable-energy options offered by other groups. Discussion centered on different

³³ NC GreenPower is an independent, nonprofit organization established to improve North Carolina’s environment through voluntary contributions toward renewable energy. A landmark initiative approved by the N.C. Utilities Commission, NC GreenPower is the first statewide green energy program in the nation supported by all the state’s utilities. NC GreenPower is entirely voluntary, with the revenue going toward paying incremental costs of renewable energy generation.

versions of renewable resource potential offered in different versions of the “La Capra” report. In all of the versions discussed, the amount of resource potential available was 20 or more times as much as is required by the program in RCI-9. The CAPAG requested, however, that the available resource potential be reviewed. The December, 2006 version of the La Capra report³⁴ list (Table ES-2) a total renewable electricity resource potential (“practical energy potential”) of 16,700 GWh per year by 2017, excluding capacity from offshore wind or solar PV generating resources. This potential is somewhat more than the total renewable electricity required by this and other RCI options, plus the total renewable electricity required by the sum of all Energy Supply TWG options.

Goals for bulk purchase program: Address purchase of 10 percent of electricity-consuming equipment purchased annually by state agencies, and 1 percent of electricity-consuming equipment purchased annually by all commercial/institutional sector consumers. Devices purchased under bulk purchase program consume 20 percent less electricity, on average, than devices that would otherwise have been purchased.

Timing: Build on the existing NC GreenPower to reach the goals above. Develop bulk purchasing programs by 2010, and ramp up to full capacity by 2018.

Parties Involved: State facilities, electric utilities, renewable energy producers, electricity consumers, and buyers of energy-using appliances and equipment.

Other: Ensure that the economic value of renewable energy generation produced in the state is included in value judgments along with air quality and other benefits.

Implementation Mechanisms

Potential implementation mechanisms and supporting activities for this mitigation option include mechanisms targeted to increasing green power demand and supply, and mechanisms that can increase the bulk purchase of high-efficiency appliances and equipment. Some of these mechanisms are described below:

The following are suggestions for state policies that are designed to increase both supply and demand for green power, thus increasing the climate change mitigation efforts. Most recommendations are also designed to improve economic development in the state.

Demand-Side Recommendations:

- In order to demonstrate leadership in this area, state facilities can be mandated to purchase a certain percentage of their power as green power (for example, through NC GreenPower or a similar agency).
- The state can provide economic development incentives for new or expanding businesses to purchase green power, and tax credits to companies that purchase green power or that support green power purchases by their employees.

³⁴ ANALYSIS OF A RENEWABLE PORTFOLIO STANDARD FOR THE STATE OF NORTH CAROLINA, TECHNICAL REPORT, prepared by La Capra Associates for the North Carolina Utilities Commission, and dated December, 2006. Document available as <http://www.ncuc.commerce.state.nc.us/rps/NC%20RPS%20Report%2012-06.pdf>.

- The state can provide incentives for home builders to include one year of green energy with the purchase of new homes.
- The state can provide assistance and participation in consumer and business marketing programs for green power.
- The NC Department of Environment and Natural Resources can work with the US Environmental Protection Agency to ensure that green power is an option for air quality violator restitution.
- The state can ensure that the air quality benefits of renewable energy programs such as green power purchase are wedded to other benefits such as waste reduction, greenhouse gas emission reductions, and economic development.

Resource-Side Recommendations:

- The state can provide support for research efforts on, and feasibility studies of, new and developing renewable energy technologies. This support is designed to foster new technology business in the state.
- The state can provide a mechanism for long-term contract guarantees for renewable energy producers through green power programs. Currently, it is difficult to get financing for some projects due to the lack of long-term contracts.
- The state can provide support for larger renewable energy development projects. In the current program, energy is purchased after customers have signed up for the program. By sponsoring large developments prior to customer sales, the program will have more options and sales tools.
- The state can work to ease ridge laws in the mountains to allow for wind energy development. Further, the state can work with the military to provide for wind energy development in coastal areas currently being blocked.
- The state can provide low or no interest loans for qualified developers of renewable energy projects.
- Green power purchase programs will interact with supply-side RPS (renewable portfolio standard) options, and thus their development and evaluation will need to be coordinated with Energy Supply group Mitigation Options.

For implementation of equipment and appliance bulk-purchase programs

- Bulk purchasing programs can interact with utility programs. It may be useful to use these programs in combination with standards for appliance purchases by state agencies.

Related Policies/Programs in Place

- **SEO CONTRACT, NC GreenPower Marketing.** The North Carolina GreenPower Program has been in place for approximately 3 years. It solicits voluntary contributions from utility customers for use in subsidizing green power purchases in North Carolina (TWG member input).
- **SEO CONTRACT, Heat Pumps in Manufactured Homes.**

- SEP recommends state procurement of environmentally preferable products.
- **SEP 7-5:** State agencies can lead by example by establishing a certain minimum level of electricity to be derived from renewable sources, such as the North Carolina GreenPower Program, or via installation of state-owned renewable energy projects.
- **SEP 7-6:** North Carolina Department of Administration can require that all state facilities with motors larger than 5 horsepower must develop a motor maintenance program.
- **SEP 10-3:** North Carolina can evaluate whether facilities that repair or rewind motors should be certified or otherwise meet a state efficiency requirement.
- **General Statute 143, Article 3B:** Energy Conservation in Public Facilities. Part 1. Energy Policy and Life-Cycle Cost Analysis. **143-64.10. through 143-64.16.**

Types(s) of GHG Reductions

GHG impacts are similar in nature to those noted for RCI-1 through RCI-3 above.

Estimated GHG Reductions and Costs (or Cost Savings)

Green Power Purchasing (required for State facilities) and Bulk Purchasing Programs for Energy Efficiency or Other Equipment	2010	2020	Units
GHG Emission Savings	0.1	0.5	MMtCO ₂ e
Net Present Value (2007-2020)		\$11	\$ million
Cumulative Emissions Reductions (2007-2020)		3.5	MMtCO ₂ e
Cost-Effectiveness		\$3	\$/tCO ₂ e

Data Sources: CBECS (USDOE EIA Commercial sector survey), incremental cost of green power from existing programs in Western US.

Quantification Methods: Apply green power requirements to State facilities, fraction of non-state buildings. For bulk purchase program, assume fraction of building energy use covered, rate of replacement of devices, and savings due to purchase of higher-efficiency devices, and apply to State and non-State electricity use.

Key Assumptions: Incremental cost for green power: \$25/MWh in 2006, declining by 2017 to the average incremental cost of an estimated \$16.71, associated with the 10% Renewable Portfolio Standard (for an “expanded” RPS without energy efficiency) as modeled by La Capra Associates for North Carolina.³⁵ Net cost of bulk purchase programs are assumed similar to net cost of market transformation programs for this initial analysis. **State building**

³⁵ *Analysis of a Renewable Portfolio Standard for the State of North Carolina, Technical Report*, prepared by La Capra Associates for the North Carolina Utilities Commission, and dated December, 2006. Document available as <http://www.ncuc.commerce.state.nc.us/rps/NC%20RPS%20Report%2012-06.pdf>.

electricity consumption estimate. Assumption that non-State government buildings are NOT covered by green power targets under this option.

Key Uncertainties

- *Degree of coverage of State and private sector participation/purchases of electrical equipment under the in bulk purchase program, and average savings from devices purchased under the program.*

Additional Benefits and Costs

Benefits

- In some cases green power has been more resistant to cost swings than conventional power.
- If power purchased through a green power is produced inside the state, there are also economic development benefits.

Costs

None Cited.

Feasibility Issues

None Cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

RCI-10 Distributed Renewable and Clean Fossil Fuel Power Generation

Mitigation Option Description

Distributed generation with clean power systems reduces fossil fuel use and greenhouse gas emissions as well as providing electricity system benefits. Implementation of these systems should be encouraged through a combination of regulatory changes and incentive programs. This option is targeted at small to medium-sized facilities, generally less than 10 MW.

Mitigation Option Design

It is recommended 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. Elements of this Option Design include:

- Review existing net-metering policies, including policies that affect electricity consumers who install on-site combined heat and power or distributed generation fueled with renewable or fossil fuels. Consider the impact of NO_x and power factor requirements on net-metering and availability of information for small customers.
- Review rate issues in NC, including 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 for renewable energy applications such as photovoltaics and other renewable power sources, including tax incentives.
- Promote clean combined heat and power in all sectors. New and existing technologies allow CHP to be used in residential, commercial sectors as well, so these sectors should be included.³⁶ CHP included here will emphasize smaller generation capacities.
- Funding of research and development for distributed renewable and clean fossil fuel power generation.
- 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.

Goals: Implementation of 25-33% of North Carolina's CHP potential by 2020. An additional 2% to 4% of all NC homes will have SHW installations by 2020. 35 additional MW of distributed

³⁶ Examples cited at the 5/23 CAPAG meeting include stacks of newly-developed ½ watt fuel cells, 1 kW residential CHP providing hot water, and micro-turbines for residential and small commercial applications. CHP options to be encouraged may also include the use of waste heat from new electricity generation units to substitute for fossil-fueled heat in the RCI sectors. In some cases of industrial CHP, it may be necessary to assess the impact of CHP presence on given distribution circuit.

renewable generation over and above RPS-related new generation by 2020. The CAPAG suggests that the TWG consider “tightening up this target and going further”, as well as coordinating goals with those considered by the Energy Supply TWG. The CAPAG also suggests reviewing USDOE goals specified for regional CHP programs in setting goals for this option.

Timing: Implement changes in regulation necessary to encourage technologies by 2008. Implement incentive program by 2008.

Parties Involved: Encouraging the development of distributed renewable and clean fossil-fueled generation will require coordination and cooperation among a number of different parties, including (but not limited to):

- Regulators (North Carolina Utilities Commission, DENR, US EPA).
- Utilities.
- Other State Agencies.
- Industry Associations.
- Equipment suppliers/vendors/installers, building professionals, engineers.
- R&D Associations.

Implementation Mechanisms

Potential implementation mechanisms and supporting activities for this mitigation option include:

- Incentives to reduce first cost to a specific payback level can be coupled with requirements for new buildings. Specific implementation measures mentioned as possible for this option include tax credits, low/no interest loans, and similar financial incentives to business, industries and commercial firms to adopt CHP/distributed generation/renewables. The latter approach is especially important for small manufacturers, and could just be access to micro-loans.
- Echoing implementation mechanisms developed for options ES-3 and ES-9 by the Energy Supply TWG, support for development of CHP systems could include:
 - Encouragement CHP systems of 20 MW or smaller (or of equivalent mechanical power) by a rapid adoption and customer-friendly implementation of FERC Order 2006 for Standardization of Small Generator Interconnection Agreements and Procedures;
 - Qualify heat use from CHP systems for existing renewable and energy efficiency incentive and loan programs;
 - Allow energy service companies to sell CHP and consumer-sited distributed generation output to third party customers; and
 - Facilitate governmental and non profit organizations to easily sell renewable energy credits and tax credits to the market place.

- Support for switching to less carbon-intensive energy resources (coal and oil to natural gas or biomass, electricity to solar water heating or space/process heat).
- Voluntary Emissions Targets for Industrial Operations.
- Can include CHP/distributed generation-related/renewables R&D contracts with private firms, grants and contracts with universities, Intramural R&D conducted at government labs, R&D contracts with private/public consortia.
- Can include patent protection, R&D tax credits, production subsidies or tax credits to firms bringing new CHP/distributed generation-related/renewables technologies to market, tax credits or rebates for new technology buyers, government procurement, and demonstration projects.
- Include methane capture and use in CHP systems at sewage treatment plants as a specific focus.
- Consider integration of distributed generation options with regional demand response initiatives/recommendations.

Expanded use of distributed renewable and clean fossil-fueled power generation in North Carolina will need to be accompanied by reviews of related regulations. Such reviews could include:

- Review of net-metering policies e.g., electricity consumers who install on-site combined heat and power or, distributed generation fueled with renewable or fossil fuels. This review could consider the impact of NO_x and power factor requirements on net-metering and availability of information for small customers.
- Utility Rate Reform - At the CAPAG Meeting on 5/23/06, it was suggested that there is a need to look harder at rate issues in NC, including decoupling of utility revenues from sales and rate design, with a specific focus on the impacts of rate design on greenhouse gas emissions.

Related Policies/Programs in Place

- Policy on net metering has been established by the NCUC, and corresponding tariffs approved.³⁷ The establishment of Small Generator Interconnection Standards³⁸ is designed to streamline the process for customers seeking to install net metering applications, as well as other small renewable energy generation applications.
- SEP recommends the Department of Commerce and the State Energy Office encourage and support economic development of energy-related enterprises whose products are intended to increase energy efficiency or use renewable resources, such as providers of specialized insulation and window products, heating and air conditioning equipment and controls, distributed generation equipment, solar and wind energy equipment, biofuels, and fuel cells.
- **SEO CONTRACT, The Center for Energy Research and Technology.**

³⁷ See in Docket No. E-100, Sub 83.

³⁸ See in Docket No. E-100, Sub 101.

- **SEO CONTRACT, Million Solar Roofs.**
- **SEO CONTRACT, North Carolina Solar Center.**
- **SEO CONTRACT, UNCA Craft Campus.**
- **SEO CONTRACT, Sustainable Community—Carrboro Collaborative.**
- **SEO CONTRACT, Sustainable Community—Town of Chapel Hill.**
- **SEO CONTRACT, SPP Brownfields to Brightfields Solar Demonstration.**
- **SEO CONTRACT North Carolina Combined Heat and Power Center.**
- **SEO CONTRACT, NC GreenPower Marketing.**
- **SEP Exec-8:** The General Assembly should reexamine existing legislation and regulations as pertains to barriers and strategies to develop wind energy while still protecting North Carolina's natural beauty.
- Integration with Regional Demand Response Initiatives/recommendations is a SEP recommendation.
- **SEP 4-1:** The North Carolina Utilities Commission is encouraged to promote policies that create diversity in energy supply such as natural gas, solar energy, wind energy, biomass, and hydrogen from renewable sources with particular emphasis on in-state energy development.
- **SEP 4-5:** Because the December, 2002, ice storm raised public interest in use of distributed generation i.e., in facilities used as public shelters, residential housing, etc., the State Energy Office should study distributed generation and appropriate applications.
- **SEP 5-4:** The State Energy Office, Department of Agriculture, and Department of Environment and Natural Resources should support landfill methane gas projects through direct grants and loans based on need, as well as technical assistance.
- **SEP 7-5:** State agencies should lead by example by establishing a certain minimum level of electricity to be derived from renewable sources, such as the North Carolina GreenPower Program, or via installation of state-owned renewable energy projects.
- **SEP 8-8:** The State Energy Office should provide training for building professionals on specific targeted technologies including residential daylighting, solar water heating, heat pump water heaters, new insulation products, and advanced HVAC systems and controls.
- **SEP 10-8:** North Carolina should create policies and regulations for distributed generation in the state, including incentives for deployment of "clean" distributed generation.
- **SEP 12-14:** The State Energy Office should sponsor a program to install solar equipment or other sustainable energy technologies on school buildings in every school district in the state.

Types(s) of GHG Reductions

- CO₂ reduction from avoided electricity production and avoided on-site fuel combustion less additional on-site CO₂ emissions from fuel used in CHP systems.
- Other gases: modest potential changes in emissions of CH₄: from avoided fuel combustion and avoided natural gas pipeline leakage, net of any additional on-site emissions or additional leakage from increased gas use, likely relatively small reductions in emissions of N₂O from avoided fuel combustion, net of any increased on-site emissions, and also some possible small net changes in emissions of black carbon, depending on the balance between avoided and additional consumption of oil, coal, and biomass fuels, and of emission control

Estimated GHG Reductions and Costs (or Cost Savings)

Distributed Renewable and Clean Fossil Fuel Power Generation	2010	2020	Units
GHG Emission Savings	1.17	4.61	MMtCO ₂ e
Net Present Value (2007-2020)		\$392	\$ million
Cumulative Emissions Reductions (2007-2020)		33.5	MMtCO ₂ e
Cost-Effectiveness		\$12	\$/tCO ₂ e

Data Sources: ONSITE SYCOM CHP potential estimates; NC Solar Center (for solar PV output; California “Million solar roofs” analysis for solar PV costs.

Quantification Methods: Modeled as three discrete elements:

- Solar water heating, with a target fraction of additional homes adopting solar water heaters over time and replacing a mixture of gas, electric, and LPG water heaters
- Combined heat and power, with a target fraction of North Carolina’s CHP potential achieved through adoption of CHP systems fueled with gas, coal, or biomass.
- Renewable distributed generation, with a target capacity divided into residential and commercial solar PV systems and consumer-sited systems fueled with landfill gas, biomass, or biogas.

Key Assumptions: Fraction of additional North Carolina households adopting solar water heating as a result of implementation of the option. Combined heat and power generation capacity (as a fraction of NC potential) achieved via RCI-10, and types of fuels used in CHP. Capacity and types of distributed renewable generation added through implementation of RCI-10.

Key Uncertainties

- Future costs of solar water heaters.
- Degree to which solar water heating targets can be attained (or exceeded).

- CHP potential in North Carolina.
- Heating fuels displaced by CHP.
- Future costs of renewable distributed generation and CHP systems.
- Types of distributed generation added.

Additional Benefits and Costs

Benefits

- Programs could help to lower capital and installation costs.
- Utility system co-benefits.
- Cost savings and decreased impacts of transmission and distribution.

Costs

None Cited.

Feasibility Issues

- Cost-effectiveness dependent on price of natural gas.
- Interconnection is an issue.

Status of Group Approval

Complete.

Level of Group Support

Unanimous Consent.

Barriers to Consensus

None.

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

Mitigation Option Description

This mitigation option includes providing residential, commercial, and industrial-sector energy technical assistance to identify options for reducing fossil energy use and reducing non-energy emissions of GHGs, along with following up on recommendations by helping to provide incentives, expertise, and information to implement recommended options.

Mitigation Option Design

It is recommended 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 the follow-up on that 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. The audit 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. Analysis can also consider alternative utility rate structures and 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 alternative utility rate structures and load control opportunities can be included as well.
- The technical assistance programs can include a follow-up mechanism 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. Other recommendations from the Working Group provide incentives and financial assistance to encourage implementation.

Additional specific recommendations are provided under Implementation Mechanisms, below.

Goals: Over 10,000 residential technical assistance visits, 1,500 commercial building technical assistance visits, and 300 industrial technical assistance visits can be conducted annually. Over

50% of those to whom services are provided should implement at least 50% of the recommendations. CAPAG direction to the TWG was to increase this goal, with a figure of 400,000 audits total, consistent with goals for improvements in existing buildings as noted in other RCI options mentioned as a possible alternative goal.

Timing: The technical assistance program can be conducted for an initial period of 3 years beginning in 2008. Each year, an evaluation should make specific recommendations for program improvements, with a goal of increasing implementation rates. After a 3-year period, an evaluation can recommend whether to continue the program.

Parties Involved:

- Utilities: Can be involved directly in the technical assistance program, or provide funding to a separate organization.
- State Agencies: The State Energy Office has managed several similar audit programs and can fund and/ or manage the effort. The Department of Environmental and Natural Resources could also manage the program. The State Construction Office could conduct technical assistance and analysis of state facilities.
- Third-party efficiency Providers: North Carolina possesses considerable expertise in its universities, nonprofit organizations, and private consulting and technical service companies to conduct technical assistance services and follow-up tasks.
- Regulators: The Public Utilities Commission, with input from the Public Staff, can be involved in utility-sponsored technical assistance programs.
- Others: A wide variety of stakeholders can provide input into the development and continued operation of the technical assistance.

Implementation Mechanisms

Potential implementation mechanisms and supporting activities for this mitigation option include:

- Participation in Voluntary Industry-Government Partnerships. For example, Climate Leaders, a USEPA program that “encourages companies to develop long-term comprehensive climate change strategies and set GHG emissions reduction goals.” A state recognition and reward program can be an effective tool for emissions reduction. This can be part of the existing Environmental Stewardship Initiative (ESI).³⁹ “Companies participating in Climate Leaders set a corporate-wide GHG reduction goal and inventory their emissions to measure progress.”⁴⁰
- Process Changes/ Optimization. Improving manufacturing so as to require less energy and/or release less GHG process gases to the atmosphere. Impacts and costs of process changes are highly process-specific.

³⁹ See <http://www.p2pays.org/esi>.

⁴⁰ See <http://yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsNationalPartnerships.html>.

- Leak Reduction /Capture, Recovery and Recycling of Process Gases (gases used in industrial processes). For example, solvents used in electronics industry, recovery of refrigerants, reduction of leaks in refrigeration equipment.
- Use of Alternative Gases (other HFCs, hydrocarbon coolants/refrigerants, foam blowing agents, etc.). For example, use of lower Global Warming Potential gases in specific applications, such as hydrocarbons in place of HFC's in commercial refrigeration. Some of these changes may affect energy use as well.
- Focus on Small and Medium Enterprises (SMEs). Provide resources for small and medium businesses to evaluate and pursue energy efficiency/GHG emissions reduction activities.
- Industrial ecology/ by-product synergy by including full circle of industrial by-product use within other industrial processes. For example, promote review and modification of industrial processes to encourage waste reduction, and highly efficient use of materials and energy.
- Integration with Regional Demand Response Initiatives/recommendations. This SEP recommendation might be relevant for RCI-11 in that technical assistance can be used to identify opportunities for industrial customers to participation in emergency demand reduction programs.
- Identify opportunities for water use reduction and consider the impacts of water use reduction on energy needed for, and GHG emissions due to, reduced transmission/distribution/treatment of water and wastewater.
- Focus should be on efficiency improvements that are long lived and require minimal proactive input from the customer once in place.
- Negotiated Emissions or Energy Savings Agreements. SEP recommends, for example, agreements between government and industrial or other large GHG emitters to reduce emissions on a specific time-frame.

Related Policies/Programs in Place

- There are a number of efforts in NC being coordinated by Industrial Extension programs. In addition, technical assistance on pollution prevention and manufacturing efficiencies is provided by DPPEA, WRP (Waste Reduction Partners) and others (for examples, see below).
- **SEO CONTRACT, DPPEA Energy Efficiency Field Assistance Waste Reduction Partners.**
- **SEO CONTRACT, Boiler Technical Assistance Program.**
- **SEO CONTRACT, Energy Management Program.**
- **SEO CONTRACT, NC Industries of the Future.**
- **SEO CONTRACT, North Carolina Combined Heat and Power Center.**
- **SEO CONTRACT, Steam Trap Survey Program.**

- **SEO CONTRACT, ElectriCities—Energy Auditor.**
- **SEP 9-5:** The State Energy Office can develop an energy audit program for existing commercial buildings to assist building managers with implementing the most energy efficient and cost effective improvements for commercial renovation projects.
- Industrial Assessment Center at NC State University provides energy conservation and cost reduction assessments to small to medium sized enterprises.⁴¹ This type of assistance is also currently provided by DPPEA and WRP, as well as the IES. In addition, the types of activities suggested in options 9.6 and 9.7 are also provided by DPPEA and WRP, and can be included in the demand side management recommendation as part of RCI-1.
- Industrial Extension Services at NC State University provides surveys and audits of industrial operations to provide suggestions on cost savings from energy efficiency.⁴² Waste Trader, an on-line waste exchange system, and Biomass Trader, a similar system for biomass, are joint projects between DPPEA and SEO that are relevant to this option.⁴³
- Waste Reduction Partners (WRP) in Western North Carolina carries out technical assistance visits in the commercial/institutional and industrial sectors. The WRP program is staffed largely by volunteer retired engineers, and provides limited "energy audit" services (Terry Albrecht of WRP, personal communication).
- Greenville (NC) Utilities operates a longstanding (since 1977) residential survey/audit program, which frequently identifies savings potential for residential customers of up to 50 percent in overall energy use. Savings found commonly include building envelope and heating/cooling system measures, but also hot water system measures including simple plumbing fixes (personal correspondence with Andy Yakim of Greenville Utilities, 5/25/07).

Types(s) of GHG Reductions

GHG impacts are likely similar in nature to those noted for RCI-1 through RCI-3 above, except that to the extent that voluntary emissions reduction efforts included as a part of this option target non-energy emissions, GHG impacts will vary on a case-by-case basis.

Estimated GHG Reductions and Costs (or Cost Savings)

⁴¹ See <http://www.mae.ncsu.edu/Centers/IAC/>.

⁴² See <http://www.ies.ncsu.edu/energysurveys/>.

⁴³ See <http://www.p2pays.org/>.

Residential, Commercial, and Industrial Energy and Emissions Technical Assistance and Recommended Measure Implementation	2010	2020	Units
GHG Emission Savings	0.5	2.1	MMtCO ₂ e
Net Present Value (2007-2020)		-\$494	\$ million
Cumulative Emissions Reductions (2007-2020)		14.9	MMtCO ₂ e
Cost-Effectiveness		-\$33	\$/tCO ₂ e

Data Sources: Adjusted costs of saved energy by sector were adapted from data in the GDS Report for the North Carolina Utilities Commission.⁴⁴

Quantification Methods: Start with target number of technical assistance visits per sector per year, and apply estimates of fractional savings per visit (via recommended measures adopted) as a fraction of per-consumer electricity, natural gas, LPG, and oil demand. Estimate net costs of energy savings for electricity and non-electric fuels, by sector, and calculate cost difference relative to electricity and gas avoided costs, and to other fuel costs.

Key Assumptions: Actual savings achieved per customer; number of technical assistance visits per sector per year.

Key Uncertainties

- Savings achieved per customer.
- Growth rate of customer count by sector.
- Cost of energy savings, including costs of technical assistance visits themselves (and including costs of visits that result in no consumer adoption of measures).

Additional Benefits and Costs

Benefits

None Cited.

Costs

None Cited.

Feasibility Issues

Impact, cost of process changes/optimization likely highly process-specific.

Status of Group Approval

Completed.

Level of Group Support

⁴⁴ GDS Associates, Inc. Report for the NC Utilities Commission, *A Study of the Feasibility of Energy Efficiency as an Eligible Resource as Part of a Renewable Portfolio Standard for the State of North Carolina*, dated 12/2006.

Unanimous Consent.

Barriers to Consensus

None.