[SUMMARY TABLE BELOW WILL BE UPDATED AS QUANTIFICATION IS COMPLETED]

Energy Supply Technical Work Group

Quantification of Mitigation Options

#	Policy Name	GHG Reductions ($MMtCO_2e$) 2010	2020	Total 2007-2020	Net Present Value (Million $)	Cost-Effectiveness ($\$/tCO_2e$)	Level of Support
ES-1	Renewable Energy Incentives	0.03	0.12	1.00	$34	$34.1	TBD
ES-2	Environmental Portfolio Standard	7.13	42.34	276.00	-$1,800	-$6.5	TBD
ES-3	Removing barriers to CHP and clean DG	0.72	2.84	20.64	$83	$4.0	TBD
ES-4a	CO2 tax and/or cap-and-trade – electric sector only	0.88	3.76	22.82	$133	$5.83	TBD
ES-4b	CO2 tax and/or cap-and-trade – economywide	1.51	5.98	39.97	$238	$5.96	TBD
ES-5	Legislative changes to address environmental & other factors	Not quantified					
ES-6	Incentives for advanced coal	0.00	8.33	66.66	$1,677	$25.2	TBD
ES-7	Public Benefit Charge	0.82	3.42	24.36	-$685	-$28.1	TBD
ES-8	Waste to Energy	0.00	0.02	0.13	-$4	-$31.37	TBD
ES-9	Incentives for CHP and clean DG	Combined with ES-3					
ES-10	NC Greenpower renewable resources program	0.02	0.21	1.26	$10	$7.9	TBD

Note that the above are initial estimates only, and will be refined over time. Further, there is overlap between some of these options—in part by design—so that the total NET emissions (and costs) savings expected will be less than the raw gross sum of the figures above.

ES-1 Renewable Energy Incentives (biomass, wind, solar, geothermal, hydro)

Mitigation Option Description

This option focuses on financial incentives that promote the greater use of renewable energy. They are focused primarily for residents, businesses, and other end-users rather than for research & development, outreach, or inter-governmental programs. The effect of these incentives is to encourage investment in renewables by providing direct financial support.

Mitigation Option Design

- **Goals:** Subsidy to renewable energy generators at 0.5 cents/kWh for each kWh of electricity generated from a qualifying renewable facility.
- **Timing:** Tie into the timing of actions taken as a result of the NCUC RPS study. As a default, implement payments starting in 2008, and continuing through 2020.
- **Coverage of parties:** All power producers operating qualifying renewable facilities in North Carolina would receive the direct payments.
- **Other:** NA

Implementation Mechanisms

The proposed implementation mechanism for this option is the direct payment mechanism. These represent direct subsidies for purchasing/selling renewable technologies given to buyer/seller. Other implementation mechanisms that are possible include a) tax credits or exemptions for purchasing/selling renewable technologies given to the buyer/seller, b) tax credits or exemptions for operating renewable energy facilities, c) feed-in tariffs which provide direct payments to renewable generators for each kWh of electricity generated from a qualifying renewable facility, and d) tax credits for each kWh generated from a qualifying renewable facility.

Related Policies/Programs in Place

NC GreenPower

Types(s) of GHG Reductions

Renewable generation can reduce fossil fuel use in power generation and correspondingly reducing CO2 emissions. To the extent that generation from coal and oil is displaced by renewables, black carbon emissions will decrease.

Estimated GHG Savings and Costs per MtCO_2e

The table below summarizes the annual GHG reductions in 2010 and 2020, the cumulative GHG reductions through 2020, the incremental cost of the option (expressed in net present value terms), and the cost-effectiveness of the option (expressed in terms of $ per ton of CO2equivalent avoided).

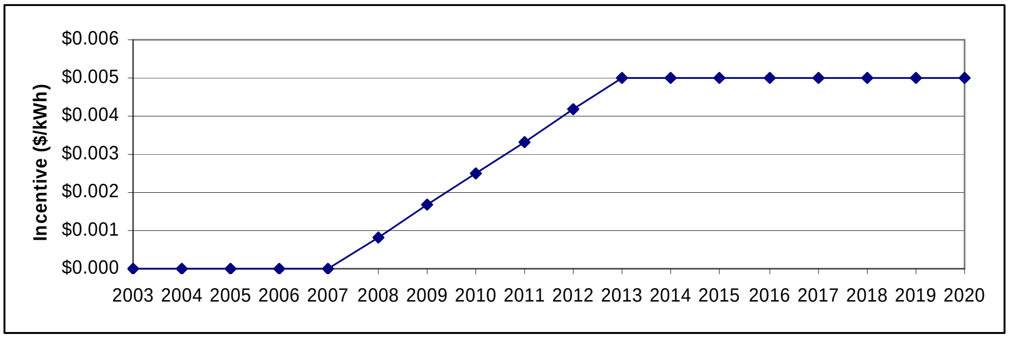
		GHG Reductions (E6 tonnes CO2-equiv)				
Option No.	Option Name	2010	2020	Total (2007-2020)	NPV of Costs (E6 2005$)	Cost of Saved Carbon (2005$/tCO2 avoided)
ES-1	Incentives for centralized renewables	0.03	0.12	1.00	$34	$34.1

- ***Data Sources:*** EIA's Annual Energy Outlook (AEO) for 2006; "Clean Energy Technologies: A Preliminary Inventory of the Potential for Electricity Generation" by Owen Bailey and Ernst Worrell, LBNL-57451, April 2005

- ***Quantification Methods:*** Ideally, one would undertake a full economic modeling exercise to assess the least cost mix/level of renewable energy, relative to NC resource constraints and the incentives proposed. However, such a modeling exercise would be both time-consuming and subject to very large uncertainties. Given time and budget limitations, an alternative analysis strategy is proposed that aims to use previous analysis within a transparent spreadsheet structure. Hence, the proposed analysis will use a simple spreadsheet tool to assess the impact that financial incentives for centralized renewables would have on the penetration of renewable energy. The initial results of the RPS study under preparation in NC will be reviewed for insights into a suitable renewable technology mix, if these results are available within the November-December 2006 time frame. The analysis involves the following steps:
  - Identify the type of renewable generation that would most likely be developed as a result of the EPS case combined with the financial incentives using a cost curve approach and taking into account renewable energy resources in NC;
  - Estimate the incremental costs associated with each type of renewable technology on a societal costs basis;
  - Estimate the incremental renewable generation resulting from the incentive on the basis of a comparison of the net program costs with and without the payments associated with the tax incentives.
  - Estimate the amount of CO_2 emissions that are expected to be avoided by the additional renewables resulting from the renewable energy incentives relative to the Reference Case.

- ***Key Assumptions:*** Where applicable, the key assumptions will be the same as those used in analyzing the EPS. It is assumed that the renewables mix developed for the EPS would be modified such that the renewables mix may be different relative to cost the competitiveness of these resources after the subsidies.

- ***Analytical issues:*** There were several assumptions that were made in quantifying the GHG reduction benefits and cost effectiveness of this option, as follows:
  - *Amount of incentive:* As per guidance from the CAPAG, the maximum level of the incentive was set at $0.005/kWh (i.e., 0.5 cents/kWh) and was phased in as per the schedule shown on the graph below.



- *Renewable energy mix:* As per guidance from the TWG during the 19 December meeting, the recently completed RPS study[1] for the Public Utilities Commission was reviewed for renewable resource potential in North Carolina and compared with other sources. Resource potential in NC from this study is summarized in the Table below.

	Generation (GWh)		Share (%)	
Resource	Maximum	Practical	Maximum	Practical
Conventional Hydropower	2,032	1,700	3%	11%
Geothermal	0	0	0%	0%
Hog waste	748	600	1%	4%
co-firing	12,207	2,500	20%	17%
Dedicated biomass	20,661	6,200	34%	42%
Solar Thermal	0	0	0%	0%
Solar Photovoltaic	0	0	0%	0%
Wind (onshore)	24,960	3,900	41%	26%
Total	60,608	14,900	100%	100%

The resource shares in the Table above are considerably different from Energy Information Agency (EIA) estimates, which show mostly wind (81%) and the rest consisting of municipal waste (19%). Hence, the analysis was set up to consider three sensitivities, as follows:

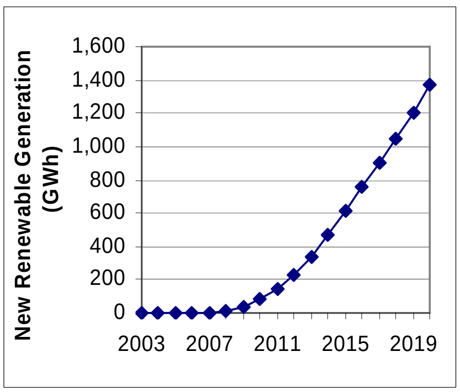
- 1 - LaCapra "practical": This corresponds to the practical assumptions in the RPS report. **Note that this was the default assumption**.
- 2 - LaCapra "technical potential": This corresponds to the maximum assumptions in the RPS report
- 3 - EIA estimates for SERC: This corresponds to the EIA assumptions.

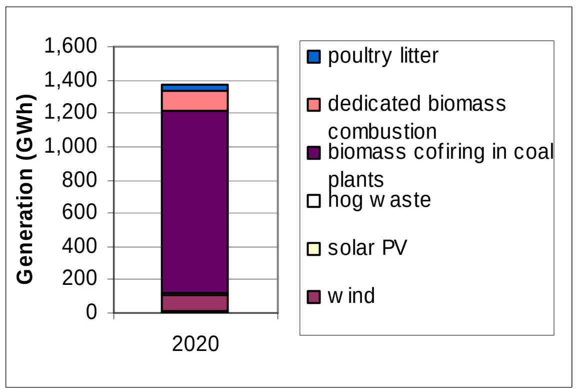
- *Levelized costs:* Levelized cost assumptions in 2020 are provided in the Table below. These are central values. At this stage of the analysis, there were no sensitivities considered for either capital costs or fuel.

Resource	Levelized Cost (2005$/MWh)
Hydro	128.0
Wind	54.9
Dedicated biomass	65.7
Hog wastes	54.4
Poultry litter	27.6
Biomass cofiring	3.0
Solar PV	189.2

[1] LaCapra Associates, 2006, *Analysis of a Renewable Portfolio Standard for the State of North Carolina*, December

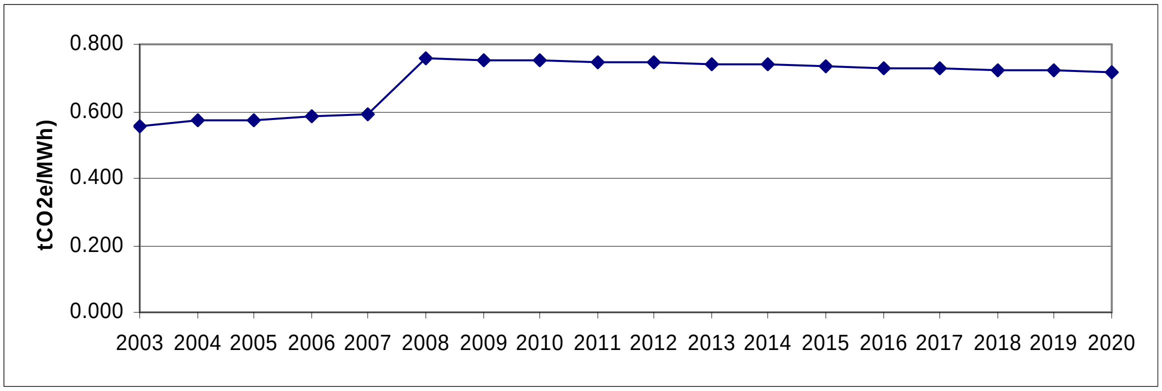
- *Avoided costs:* The RCI TWG calculated the avoided costs associated with electric sector expansion. Avoided costs were calculated starting with the levelized 15-year avoided costs from Duke Power, Progress Energy, and Dominion Resource Services price schedules for qualifying facilities purchased power, as filed in late 2005 with the NCUC (Docket No. E-100, Sub 100). Weighted average annual avoided costs were developed by application of estimated weighting factors for on-peak and off-peak usage, and for the fraction of North Carolina's electricity supplied by each of the three utilities. The implied utility-weighted average avoided cost was computed to be **$57/MWh**.
- *Marginal impact of renewable generation:* The introduction of new renewable generation associated with the incentive is assumed to displace generation from existing and/or new facilities. The analysis assumes that 50% of the generation displaced by the new renewable generation would be coal-fired and the balance natural gas-fired.
- *New renewable generation:* It was assumed that the level of new renewable generation would be constrained, given the low level of the incentive. It was further assumed that the level of new generation would be less than the renewable generation levels in the Reference Case. The graphs below show the total incremental renewable generation assumed to come on line by the incentives between 2003 and 2020, as well as the new renewable generation mix in 2020.





- *System CO2-equivalent emission factor:* The introduction of new renewable generation will lead to different reductions of greenhouse gases (GHG) depending upon whether the full fuel cycle is considered, or whether only GHG emissions are considered at the point of generation. Since it was unclear how the TWG would opt to proceed, the analysis was set up to consider two sensitivities, as follows:
  - 1 – Full fuel cycle emissions associated with electric supply. This assumes that upstream stages of the full fuel cycle (e.g., extraction, transport, beneficiation, etc) are considered the development of CO2e emission factors. **Note that this is the default assumption and the results reflect this assumption.**
  - 2 –Emissions associated with electric generation only. This assumes that only the generation stage of the fuel cycle is considered the development of CO2e emission factors.

  Generation-specific average system emission factors were determined based on information developed in the NC Inventory and Forecast analysis. Full fuel cycle emission factors were determined based on US Department of Energy sources for upstream emissions. The graph below shows the average emission factor associated with the generation displaced by new renewable generation.



Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

ES-2 Environmental Portfolio Standard (renewables and energy efficiency) with renewable energy credit trading

Mitigation Option Description

A renewable portfolio standard (RPS) is a policy requiring investor-owned electric utilities to supply a certain percentage of retail electricity from renewable energy sources by a stipulated date. An RPS that includes measurable, verifiable and lasting efficiency options is an Environmental Portfolio Standard (EPS). Utilities can satisfy the EPS requirement by generating renewable energy themselves or by purchasing renewable energy credits (REC) from a renewable energy generator. A REC is equal to 1 kWh of eligible and verified renewable electricity produced.

Mitigation Option Design

Eligible renewable sources and energy efficiency applications are as briefly outlined in the paragraphs below:

Renewables: Solar PV; wind power; micro-hydropower (< 20MW); ocean current, tidal and wave energy; fuel cells using renewable fuels; and biomass including hog waste using an innovative waste management system that does not employ a lagoon, non-woody energy crops, wood wastes, anaerobically digested waste biomass and other animal waste biomass.

Efficiency: applications that provide measurable, verifiable, long-term savings to the retail customer as compared to current technology in use, including but not limited to appliances, HVAC, efficient motors, etc.

- **Goals:** A 20% EPS by 2020, starting in 2008, with a minimum of 10% renewable generation by 2017. The RPS ramps up 1% per year over the 2008-2017 period.
- **Timing:** as noted above
- **Coverage of parties:** All power producers operating qualifying renewable facilities in North Carolina would participate.
- **Other:** NA

Implementation Mechanisms

This is a command/control policy requiring a legislative act by the NC General Assembly, and/or mandated by the North Carolina Utilities Commission, within their jurisdiction.

Related Policies/Programs in Place

NC GreenPower and RPS Cost-Benefit Study

Types(s) of GHG Reductions

Carbon dioxide from displaced coal, NG combined cycle and combustion turbine facilities; Methane through the use of animal waste-to-energy and landfill gas-to-energy (LFGE) resources; and aerosols from displaced coal.

Estimated GHG Savings and Costs per $MtCO_2e$

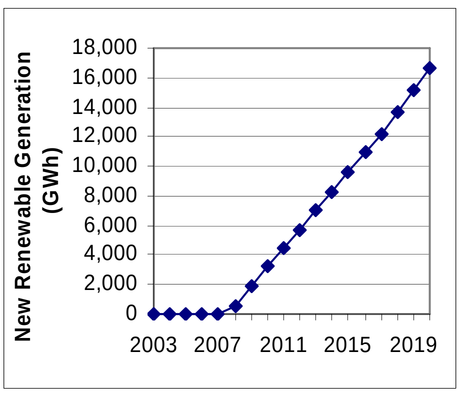
The table below summarizes the annual GHG reductions in 2010 and 2020, the cumulative GHG reductions through 2020, the incremental cost of the option (expressed in net present value terms), and the cost-effectiveness of the option (expressed in terms of $ per ton of CO2-equivalent avoided).

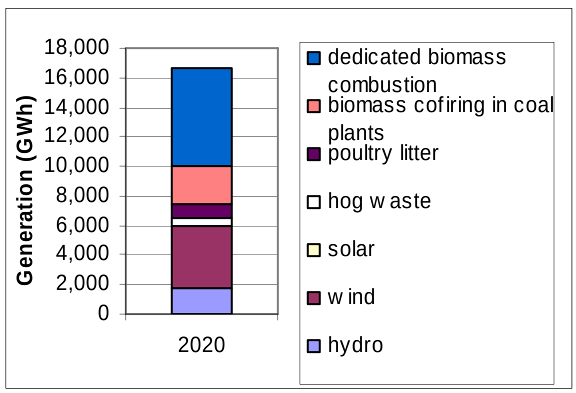
		GHG Reductions (E6 tonnes CO2-equiv)				
Option No.	Option Name	2010	2020	Total (2007-2020)	NPV of Costs (E6 2005$)	Cost of Saved Carbon (2005$/tCO2 avoided)
ES-2	Environmental performance standard	7.13	42.34	276.00	($1,800)	($6.5)

- ***Data Sources:*** EIA's Annual Energy Outlook (AEO) for 2006; "Clean Energy Technologies: A Preliminary Inventory of the Potential for Electricity Generation" by Owen Bailey and Ernst Worrell, LBNL-57451, April 2005; LaCapra Associates, 2006, "Analysis Of A Renewable Portfolio Standard For The State of North Carolina", December
- ***Quantification Methods:*** The proposed analysis will use a simple spreadsheet tool to compare the aggregated costs and the efficiency and renewable components of the EPS scenario. It will involve the following steps:
  - Identify the type of renewable generation that would most likely be used to meet the EPS' renewable energy targets of 10% by 2017 using a cost curve approach and taking into account the magnitude of renewable energy resources in NC;
  - Identify the types of efficiency measures that to meet the EPS' energy efficiency target of 20% by 2020 in coordination with the RCI TWG;
  - Estimate the incremental costs of the energy efficiency and renewable generation to meet the targets on a societal costs basis; and
  - Estimate the amount of CO_2 emissions that are expected to be avoided by the renewables, relative to the reference case, from the EPS.
- ***Key Assumptions:*** The NC RPS is met with a combination of the resources as indicated under mitigation option design. Wind will likely represent a large share of the resources. The cost of renewable generation will include costs associated with connecting renewable technologies to the electric grid, and transmitting the renewable generation to loads.
- ***Analytical issues:*** There were several assumptions that were made in quantifying the GHG reduction benefits and cost effectiveness of this option, as follows:
  - *Energy efficiency target portion of the EPS:* Though the energy efficiency targets indicated above are very similar to the energy efficiency targets analyzed in the RCI TWG, they are not exactly the same (e.g., 19.8% in 2020 for the RCI TWG; 20% in 2020 as per the CAPAG). Hence, the analysis was set up to consider two sensitivities, as follows:

- ➢ 1 – Annual energy efficiency targets as developed by the RCI TWG: **Note that this was the default assumption**.
- ➢ 2 - Annual energy efficiency targets as proposed by the CAPAG: This corresponds to the maximum assumptions in the RPS report

- ❑ *Renewable energy mix:* See the discussion under ES-1. The same default assumptions were used.
- ❑ *Levelized costs:* See the discussion under ES-1.
- ❑ *Avoided costs:* See the discussion under ES-1.
- ❑ *Marginal impact of energy efficiency and renewable generation:* The total level of projected electric generation displaced by the energy efficiency and renewable energy component of the EPS exceed total projected generation from load growth. This occurs in 2016. For this year onward, it was assumed that existing coal units that were built prior to the enactment of New Source Performance Standards in 1977 would be retired. It was assumed that these plants are fully depreciated and that incremental costs of the option should be calculated relative to their fuel and O&M costs only.
- ❑ *New renewable generation:* The graphs below show the total incremental renewable generation assumed to come on line between 2003 and 2020, as well as the new renewable generation mix in 2020.

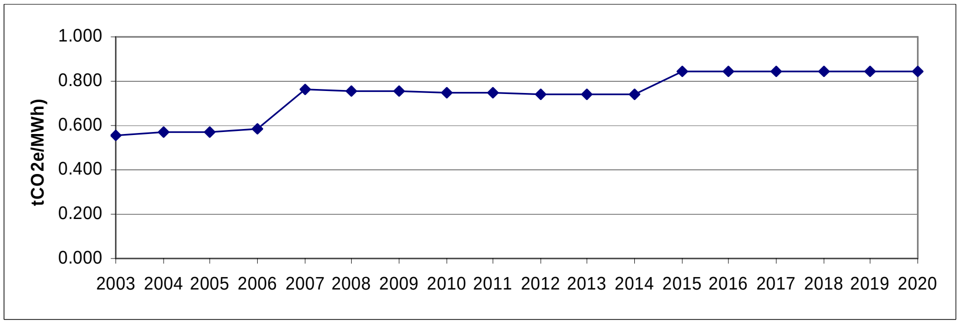


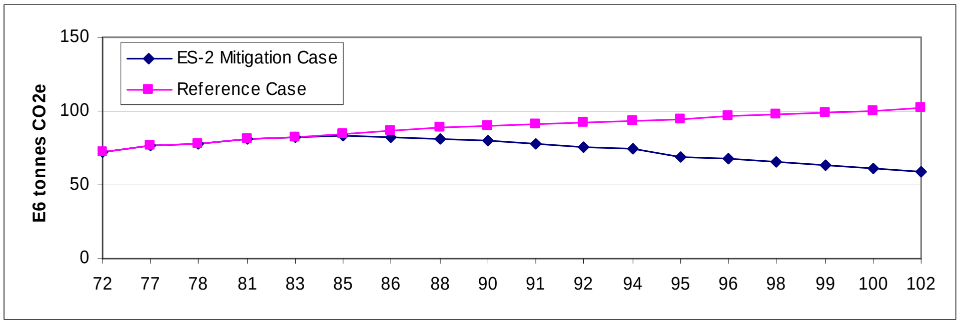


It is important to note that the amount of new renewable generation in 2020 exceeds the "practical" resource potentials identified in the LaCapra report, as summarized in the Table below. However, the levels are well within the maximum resource potentials identified in the LaCapra report.

	Generation (GWh)		
Resource	ES-2	LaCapra	Difference
hydro	1,799	1,700	6%
wind	4,127	3,900	6%
solar	0	0	NA
hog waste	635	600	6%
poultry litter	846	800	6%
biomass cofiring in coal plants	2,645	2,500	6%
dedicated biomass combustion	6,560	6,200	6%
Total	16,612	15,700	6%

- ❑ *System CO2-equivalent emission factor and emission reductions:* The top graph below shows the average emission factor associated with resources displaced under default assumptions for the EPS option. The bottom graph shows annual CO2-equivalent emissions of the NC electric sector before and after the introduction of the EPS





Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

ES-3 and ES-9 Removing Barriers and Providing Incentives to CHP and Clean DG

Mitigation Option Description

Combined Heating Cooling and Power (CHP), also know as cogeneration, is a method of utilizing the thermal energy (heat) produced when generating electricity (power) in a single, coordinated process. CHP is more energy efficient than separate generation of electricity at a separate central electric plant and production of localized thermal energy for the end user. This distributed generation resource allows for recycling the heat, which is normally wasted to cooling towers or lakes at centralized electric generating stations, to meet onsite thermally driven demand such as process and space heating, cooling and dehumidification.

Mitigation Option Design

The proposed policy would encourage the adoption of CHP through a combination of regulatory improvements and expanded incentives designed to improve interconnection and net metering standards, adopt output based emission standards, and allow GHG friendly business arrangements, such as third party ownership of CHP based generation.

- **Goals:** 50 percent of North Carolina's 4,000 MW of planned new electric generation will be CHP.
- **Timing:** Goal should be achieved by 2018, within the time frame for new generation additions.
- **Coverage of parties:** NC Utilities Commission, Utilities, NC Sustainable Energy Assoc.
- **Other:** NA

Implementation Mechanisms

This is a command and control policy that would be implemented with the following steps: 1) Encourage CHP systems of 20 MW or smaller (or of equivalent mechanical power) by a speedy adoption and customer friendly implementation of FERC Order 2006 Standardization of Small Generator Interconnection Agreements and Procedures, 2) Qualify recycled energy from CHP generation for existing renewable and energy efficiency incentive and loan programs, 3) Allow energy service companies to sell CHP and CDG output to third party customers, and 4) Facilitate governmental and non profit organizations to easily sell renewable energy credits and tax credits to the market place.

Related Policies/Programs in Place

The policy design statements point to key related policy and programs which already exist in NC, at the national level and other states such as Connecticut, New York, Texas and California for successfully implementing CHP and CDG

Types(s) of GHG Reductions

Substantial carbon dioxide reductions would be achieved from displaced coal generation.

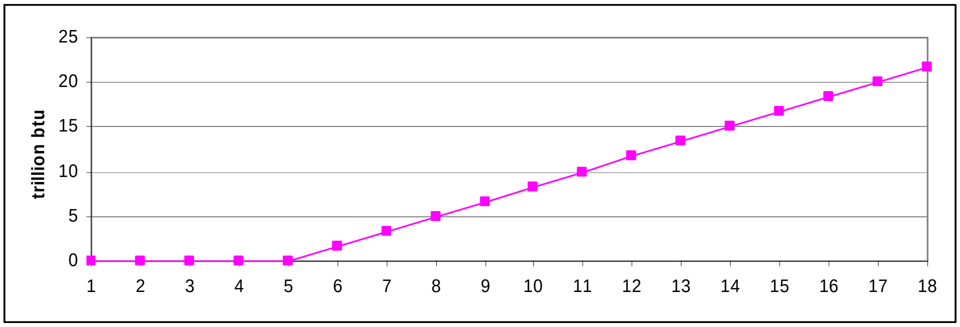
Estimated GHG Savings and Costs per $MtCO_2e$

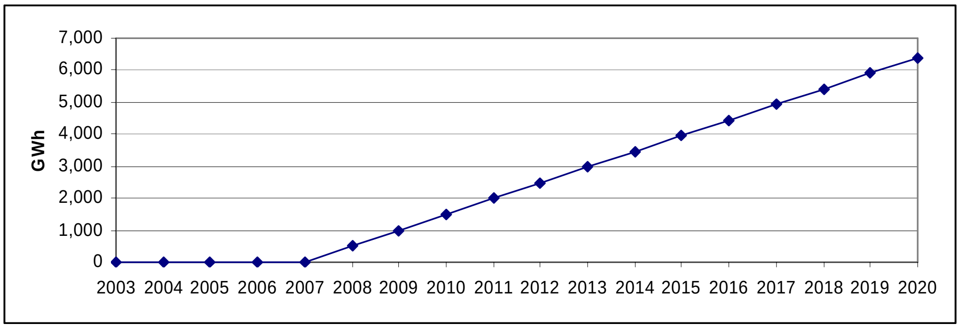
The table below summarizes the annual GHG reductions in 2010 and 2020, the cumulative GHG reductions through 2020, the incremental cost of the option (expressed in net present value terms), and the cost-effectiveness of the option (expressed in terms of $ per ton of CO2-equivalent avoided).

		GHG Reductions (E6 tonnes CO2-equiv)				
Option No.	Option Name	2010	2020	Total (2007-2020)	NPV of Costs (E6 2005$)	Cost of Saved Carbon (2005$/tCO2 avoided)
ES-3 & ES-9	CHP incentives and barrier removal	0.72	2.84	20.64	$83	$4.0

- ***Data Sources:*** EIA's Annual Energy Outlook (AEO) for 2006; *Combined Heat and Power White Paper*, dated January, 2006, prepared for the Clean and Diversified Energy Initiative of the Western Governors Association based on a study in 2003 for NREL by Energy and Environmental Analysis
- ***Quantification Methods:*** The proposed analysis will use a simple spreadsheet tool to evaluate the costs and benefits associated with introducing 2,000 MW over the study period. It will involve the following steps
    - The starting point for the analysis is to develop a better understanding of the CHP in NC, based on a review of available studies. This will help to confirm a key assumption of the analysis that there exists at least 2,000 MW of CHP potential by 2020, as well as identify a working split between commercial and industrial CHP.
    - Integrate assumptions regarding the penetration of and fuel shares for new CHP systems, estimates of future capacity of CHP developed under the policy, and CHP cost and performance for different kinds of systems into a spreadsheet model to estimate the overall net GHG emissions reduction and net cost of the policy. The avoided GHG emissions will be estimated in a manner consistent with the analysis of demand reduction options in RCI.
- ***Key Assumptions:*** A key assumptions is that CHP potential is at least 2,000 MW, and can be phased in at an acceptable rate. Systems are assumed to operate an average of 5000 hours per year (at full capacity), and 90 percent of co-generated heat is assumed to be usable (and displaces heat from purchased fuels). Gas-fired, biomass-fired, and coal-fired capacity are assumed, with a mix that includes a heavy reliance on natural gas.
- ***Analytical issues:*** There were several assumptions that were made in quantifying the GHG reduction benefits and cost effectiveness of this option, as follows:
    - *CHP targets:* The CAPAG indicated that a sensitivity analysis should be conducted regarding the level of penetration of CHP systems. Hence, the analysis was set up to consider the following sensitivities.
        - 1 – 50% of the target is met: This corresponds to 1,000 MW of new CHP capacity. **Note that this was the default assumption and the result reflect this assumption**.
        - 2 - 90% of the target is met: This corresponds to 1,800 MW of new CHP capacity.
    - *Fuel mix:* It was assumed that the fraction of new CHP capacity fueled with NG was 90%, with the remaining 10% split evenly between biomass and coal.

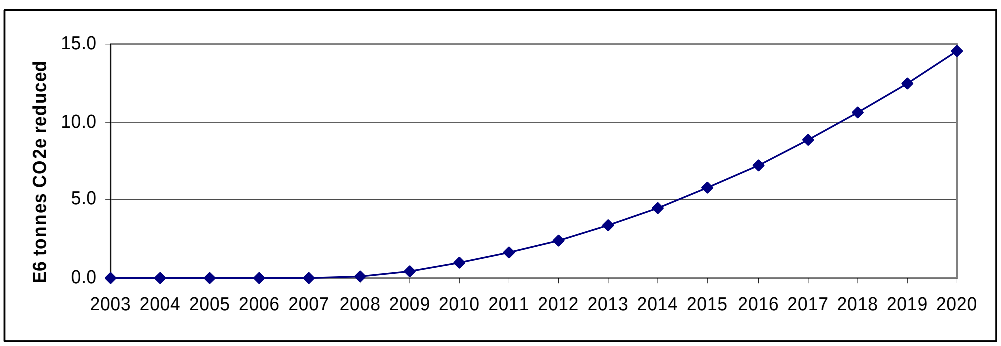
- *Energy and system electricity displaced by CHP:* CHP electric production characteristics as well and system transmission and distribution (T&D) losses were accounted for to estimate annual fuel and system electric generation displaced, as shown on the graph below:





- *Marginal impact of CHP:* See the discussion under ES-1. The same default assumptions were used.

- *CO2-equivalent emission factor and cumulative emission reductions:* See the discussion under ES-1 for electric supply. The same default assumptions were used. For fuel, standard IPCC emission factors were used for natural gas, coal, biomass, and oil. The graph below shows cumulative CO2-equivalent emission reductions associated with CHP systems.



Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

ES-4 CO2 tax and/or cap-and-trade (including covering sources including fossil, renewable, and nuclear on life-cycle basis)

Mitigation Option Description

A cap and trade system is a market mechanism in which CO2 and other GHG emissions are limited or capped at a specified level, and those participating in the system can trade permits (a permit is an allowance to emit one ton of CO2 and GHG) in order to lower costs of compliance. For every ton of CO2 and GHG released, an emitter must hold a permit. Therefore, the number of permits issued or allocated is, in effect, the cap. The government can give permits away for free (according to any one of many different criteria to those participating in the cap & trade system or even to those who are not), auction them, or a combination of the two. Participants can range from a small group within a single sector to the entire economy and can be implemented upstream (at the level of fuel extraction or import) or downstream at the points where fuel is consumed.

Mitigation Option Design

A cap and trade program applicable to North Carolina sources would be implemented on a national or regional (i.e., multi-state) basis. A program covering the power sector alone will be analyzed. It is important to note that the purpose of assessing a cap and trade program within the TWG process is to consider the GHG reductions and costs (or cost savings) of such a policy, not to define the details of a prospective regulatory program

- **Goals:** GHG intensity reduction of about 2%/year over the 2010-2020 period. .
- **Timing:** Program start-up in 2008.
- **Coverage of parties:** NC Utilities Commission, Utilities
- **Other:** NA

Implementation Mechanisms

This is a market-based mechanism with an underlying regulatory obligation.

Related Policies/Programs in Place

No cap & trade system is in place in North Carolina

Types(s) of GHG Reductions

A cap & trade system will impose a direct limit on CO2 emissions. Reductions are determined by the level of the cap. To the extent that generation from coal and oil declines under a cap and trade system, black carbon emissions will also decrease.

Estimated GHG Savings and Costs per $MtCO_2e$

The table below summarizes the annual GHG reductions in 2010 and 2020, the cumulative GHG reductions through 2020, the incremental cost of the option (expressed in net present value terms), and the cost-effectiveness of the option (expressed in terms of $ per ton of CO2-equivalent avoided).

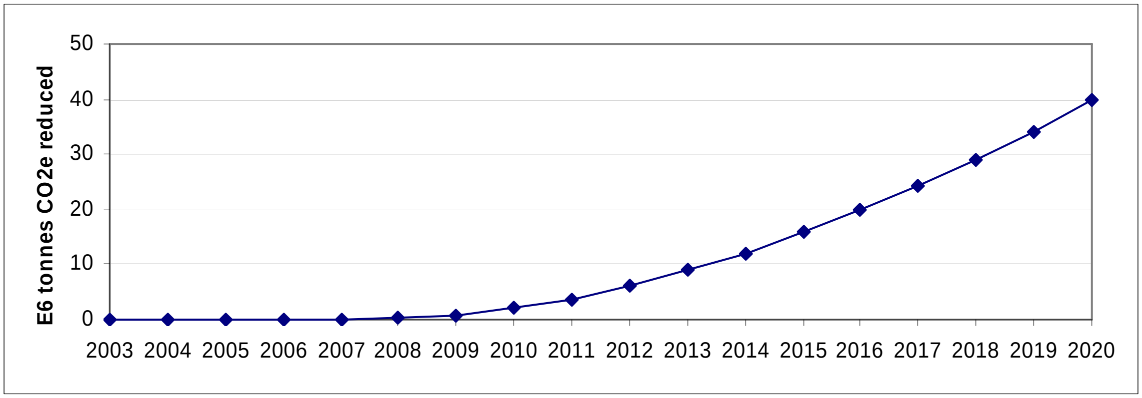
		GHG Reductions (E6 tonnes CO2-equiv)				
Option No.	Option Name	2010	2020	Total (2007-2020)	NPV of Costs (E6 2005$)	Cost of Saved Carbon (2005$/tCO2 avoided)
ES-4	Cap GHG and trade					
	electric sector only	0.88	3.76	22.82	$133	$5.83
	economywide	1.51	5.98	39.97	$238	$5.96

- ***Data Sources:*** EIA GPS report (see below)
- ***Quantification Methods:*** A parameterization approach was used to assess this policy. This is due to the fact that the analysis of a cap and trade system in North Carolina would be highly complex involving sophistical modeling techniques and difficult to do well given time and resource constraints. The parameterization techniques involve the downscaling of results of the GHG cap-and-trade study done by the Energy Information Administration (EIA) in a Congressional Service Report from March 2006 entitled *"Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals"* based on the use of the National Energy Modeling system model (NEMS) based on the Annual Energy Outlook of 2006. This is an updated analysis of an earlier EIA report entitled: *"Impacts of Modeled Recommendations of the National Commission on Energy Policy"* dated April 2005 which had been prepared by the EIA using the Annual Energy Outlook of 2005 in response to a request from Senator Jeff Bingaman, ranking Minority Member of the U.S. Senate Committee on Energy and Natural Resources, to assess the impact of, among others, a GHG cap-and-trade policy for the USA.
- ***Key Assumptions:*** The EIA study is a national study, which can be downscaled for application to NC using parameterization techniques.
- ***Analytical issues:*** There were several assumptions that were made in quantifying the GHG reduction benefits and cost effectiveness of this option, as follows:
  - *Analysis cases:* As per the CAPAG direction, two cases were considered. The first assumes that a cap (expressed as a carbon intensity per unit of economic output) is placed only on the electric sector. The second case assumes that a cap (expressed as a carbon intensity per unit of economic output) is placed on the electric and demand sectors.
  - *Scenarios analyzed:* The analysis upon which the paramterization is based considered four scenarios, as follows:
    - Cap & trade #1: This assumes a GHG intensity reduction of 2.4%/year between 2010 and 2019. The trading price is $6.16/tCO2e and $9.86/tCO2e in 2010 and 2020, respectively. **Note that this is the default assumption and the results reflect this assumption.**
    - Cap & trade #2: This assumes a GHG intensity reduction of 2.6%/year between 2010 and 2019. The trading price is $8.83/tCO2e and $14.13/tCO2e in 2010 and 2020, respectively
    - Cap & trade #3: This assumes a GHG intensity reduction of 2.8%/year between 2010 and 2019. The trading price is $22.09/tCO2e and $35.34/tCO2e in 2010 and 2020, respectively

- Cap & trade #4: This assumes a GHG intensity reduction of 3.0%/year between 2010 and 2019. The trading price is $30.92/tCO2e and $49.47/tCO2e in 2010 and 2020, respectively

- *Parameterization approach:* It was assumed that a national cap-and-trade system had been implemented. The aim of the parameterization is to extract the impact on NC from this national policy. A simple scaling from the national to the state level was performed based on the percent GHG reductions from the Reference Case. Total costs of the policy were calculated on the basis of the GHG reduction achieved in NC and the national credit price.

- *CO2-equivalent cumulative emission reductions:* The graph below shows cumulative CO2-equivalent emission reductions associated with the cap & and trade option.



Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

ES-5 Aligning Environmental and Profit Incentives through Electric Sector Regulatory/Rate Reform

Mitigation Option Description

Several regulatory and rate reforms in North Caroline would encourage electric utilities to invest in clean, non-carbon-producing energy resources such as renewables and energy efficiency. Under the current rate structure, utilities have an incentive to invest in new large capital projects, which also may inhibit investments in energy efficiency. North Carolina could align the regulated electric utilities' profit motive with increased energy efficiency by removing perverse disincentives to energy efficiency.

Mitigation Option Design

Aligning environmental and profit incentives could be accomplished by action on the part of the Utilities Commission to reform the rate structure through a) decoupling profits from sales volume, b) making lost revenue adjustments, and developing inverted block rates. Moreover, the Utilities Commission should require electric utilities to consider the costs associated with future regulation of carbon dioxide emissions when evaluating both supply-side (*e.g.*, new power plants) and demand-side (*e.g.*, energy efficiency) resource options. Aligning environmental and profit incentives in North Carolina would involve the following:

- *Decoupling Profits from Sales.* In a decoupled rate structure, utility profits are based on their cost of service and number of customers, rather than electricity sales. Utilities are entitled to earn enough revenue to cover fixed costs plus some profit based on their projected sales. If sales exceed projections, excess revenue is returned to ratepayers through rate adjustments the following year. If sales are lower than projection, rates are increased the following year to make up the difference.
- *Lost Revenue Adjustment.* Lost revenue adjustments reward utilities for energy generation lower than anticipated levels and remove additional profits when utility generation is higher than anticipated levels. This is accomplished by allowing utilities to recover net revenues lost due to energy efficiency programs (including decreased sales plus the administrative costs of the program) via periodic rate adjustments. Thus, the incentive for ever-increasing electricity sales is removed *and* efficiency is rewarded.
- *Inverted Block Rates for Residential Customers.* Inverted block rates, in which rates increase with consumption, can encourage efficiency for residential customers by sending customers price signals that more accurately reflect the costs of producing electricity. Because each successive "block," or increment of energy used per billing period becomes progressively more expensive, inverted block rates encourage efficiency and discourage wasteful consumption. Inverted block rates can also better serve families with low incomes.
- *Require Utilities to Use a "Carbon Adder" in Resource Selection:* "Carbon adders" are a means of accounting for possible future costs of compliance with future GHG regulations. A carbon adder is an expected future price for CO_2 that is assumed when comparing resource

options. It typically involves that utilities include in the resource selection and screening process a CO_2 cost adder.

Goals: This mitigation option will not be quantified in the analysis phase, as it is too early in the process to assign goal levels. Instead, the emphasis during the analysis phase will be to define the details of a prospective rate reform program. After this process, it may be possible to assign goal levels in some future initiative.

Timing: TWG develops the initial details of a prospective rate reform program (October 2006 – February 2007) and present this as an output of the NC Climate Change mitigation process. New legislation - based on the results of studies by the NC Utilities Commission and the NC legislature - would set the start year for implementation of reforms to be 2009.

Coverage of parties: Utilities Commission, regulated electric utilities, State Energy Office, environmental and public health groups

Other: NA

Implementation Mechanisms

This is a command/control options that requires changes to Utilities Commission rules and/or legislation by the General Assembly.

Related Policies/Programs in Place

Numerous other states have similar rate reform programs in place.

Types(s) of GHG Reductions

Greater reliance on renewables and energy efficiency would reduce dependence on electricity produced by burning coal and other fossil fuels, thereby reducing emissions of carbon dioxide and other greenhouse gases.

Estimated GHG Savings and Costs per $MtCO_2e$

- ***Data Sources:*** NA
- ***Quantification Methods:*** NA.
- ***Key Assumptions:*** NA

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

ES-6 Incentives for Advanced Coal

Mitigation Option Description

Integrated gasification combined cycle (IGCC) is an emerging technology for coal power, offering the potential for higher efficiency and reduced cost of pollutant emissions control. IGCC involves partially combusting coal under high pressure to produce a synthetic gas, which is then turned into electricity via combined cycle combustion. IGCC can be combined with carbon capture and sequestration or reuse (CCSR) in North Carolina to lead to significant CO2 emission reductions relative to those of conventional coal technology.

Mitigation Option Design

Policies for advanced fossil technologies may include mandates or incentives to use advanced coal technologies for new coal plants. Mandates could take multiple forms such as a) certain CO2 emission rates only achievable with advanced technology, or b) specifying that new coal plants be Integrated Gasification Combined Cycle (IGCC); or c) requiring that a certain percentage of new coal plants be IGCC or employ advanced fossil technologies. Incentives may be in the form of direct subsidies or assistance in securing financing. A combination of mandates and incentives is also possible.

- **Goals:** At least 1 new IGCC power plant in NC replacing a planned conventional coal addition. This goal would be reached by providing an incentive equal to the marginal cost difference between conventional coal technology and new advanced coal technology (with carbon capture/sequestration as appropriate), currently equal to about a 20-25% premium above the cost of pulverized coal plants. Utilities would be assured cost recovery regardless of whether the system includes carbon capture/storage.
- **Timing:** Program start-up as soon as possible. Tie into CPCN proceeding – where details regarding cost estimates and the incentive program can be developed.
- **Coverage of parties:** NC Utilities Commission, NC-based Utilities
- **Other:** NA

Implementation Mechanisms

This is a market-based mechanism with an underlying regulatory obligation. Implementation mechanisms would need to focus on the incentive structure, research and development, technical assistance and education, and a potential pilot plant

Related Policies/Programs in Place

Related program include rate reform/restructuring, energy efficiency resources, and environment as a criteria for decision-making, already before the NCUC in the Integrated Resource Planning proceeding. Rate programs already in place include energy conservation discount rate; time of use rates, real-time pricing, and curtailable rate options for customers.

Types(s) of GHG Reductions

Advanced fossil technologies are more efficient than conventional fossil technologies, and, therefore, have lower CO2 emission rates. Advanced fossil technologies combined with carbon capture and sequestration or reuse (CCS) could enable significantly lower CO2 emissions.

Estimated GHG Savings and Costs per $MtCO_2e$

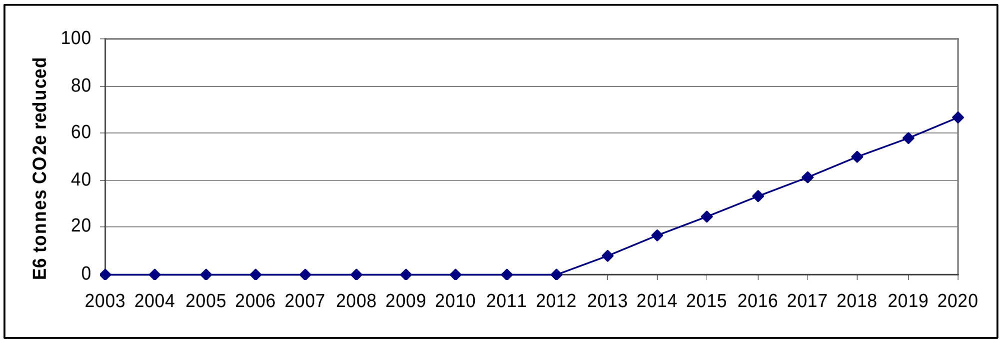
The table below summarizes the annual GHG reductions in 2010 and 2020, the cumulative GHG reductions through 2020, the incremental cost of the option (expressed in net present value terms), and the cost-effectiveness of the option (expressed in terms of $ per ton of CO2-equivalent avoided).

		GHG Reductions (E6 tonnes CO2-equiv)				
Option No.	Option Name	2010	2020	Total (2007-2020)	NPV of Costs (E6 2005$)	Cost of Saved Carbon (2005$/tCO2 avoided)
ES-6	Integrated gasification combined cycle	0.00	8.33	66.66	$1,677	$25.2

- ***Data Sources:*** EIA's Annual Energy Outlook (AEO) for 2006; IPCC report entitled "Carbon Capture and Storage", (2006)
- ***Quantification Methods:*** We propose to estimate the incremental cost of IGCC (with and without carbon capture and storage) relative to pulverized coal, and the difference in emissions using a simple spreadsheet analysis, which accounts for the additional energy needed for the capture and storage processes. We propose to estimate the costs from the following perspectives:
  - IGCC only (no carbon capture/storage)
  - IGCC with carbon capture and transmission via pipeline, storage and monitoring costs, assuming sequestration in deep saline aquifers near NC.
  - IGCC with carbon capture and transmission via truck to depleted natural gas fields in the Southwest.
- ***Key Assumptions:*** Costs of IGCC and pulverized coal plants are drawn from local sources, or from alternative sources such as AEO 2006, and assumptions for capture and storage are drawn from EPRI, MIT and IPCC.
- ***Analytical issues:*** There were several assumptions that were made in quantifying the GHG reduction benefits and cost effectiveness of this option, as follows:
  - *IGCC targets:* It was assumed that 1,718 MW of coal capacity would be displaced.
  - *Levelized costs:* Levelized cost assumptions in 2020 are provided in the Table below. Sensitivities were considered regarding cost and performance characteristics of IGCC units with carbon capture and storage. The default assumption is the central value.

Facility type	Levelized Cost (2005$/MWh)
Pulverized coal	40.7
IGCC	53.4
IGCC w/CCS - low	43.5
IGCC w/CCS - high	102.1
IGCC w/CCS - central	71.7

- *CO_2-equivalent emission factor and cumulative emissions:* An emission factor of 0.843 tCO_2e/MWh was used for pulverized coal. An emission factor of 0.405 tCO_2e/MWh was used for IGCC with carbon capture and storage. The graph below shows cumulative CO_2-equivalent emission reductions associated with the introduction of a large IGCC unit.



Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

ES-7 Public Benefits Charge on Electric Bills To Support Energy Efficiency Programs

Mitigation Option Description

A public benefits charge (sometimes call systems benefits charge) is a non-bypassable fee attributed to electric customers based on their usage of electricity in a given time period. The funds collected are then provided to a third party to provide energy efficiency programming. The purpose behind public benefits charges is most often to reduce energy consumption. While efficiency carries significant air quality and GHG benefits, that is rarely a consideration for creation of a program.

Mitigation Option Design

North Carolina already has a public benefits charge. It is the oldest such program in the USA, established in 1980 by the NC Utilities Commission. The original intent was to reduce electric demand in order to slow the need for new power plants. The current public benefits charge is $0.003567 per kWh and has not changed since its inception in 1980. It translates into approximately 3 cents/month per average residential customer in NC, and raises approximately $3.5 million per year. For other states that have implemented a public benefits charge, the average charge is equivalent to $8.44 per customer and on average raises the equivalent of $72 million per year. In North Carolina, the public benefits charge should be increased so as to result in similar funding levels.

- **Goals:** Two goal levels are recommended, with the second goal dependent upon the first. The first goal is to gradually increase the public benefit charge to eventually achieve a funding level of $72 millions per year, or equivalent to the national average. The second goal is to utilize that funding to meet about 1,000 MW per year in demand and 4,760 GWh per year in electricity consumption.
- **Timing:** Program start-up in 2008. Linearly ramp up the increase to the public benefits charge over a 3-year period.
- **Coverage of parties:** Only investor-owned electric utilities are covered by the NC Utilities Commission. In the current public benefits charge, municipal utilities and electric cooperatives are invited to participate while only electric cooperatives actually participate in the program.
- **Other:** NA

Implementation Mechanisms

The most effective implementation method would be to work through the NC Utilities Commission to increase funding in the established program. Not all funds would necessarily go to the same organization currently administering the fund.

Related Policies/Programs in Place

NC has many fine organizations providing energy efficiency services that can be supplemented and improved with a n increase to the current funding levels.

Types(s) of GHG Reductions

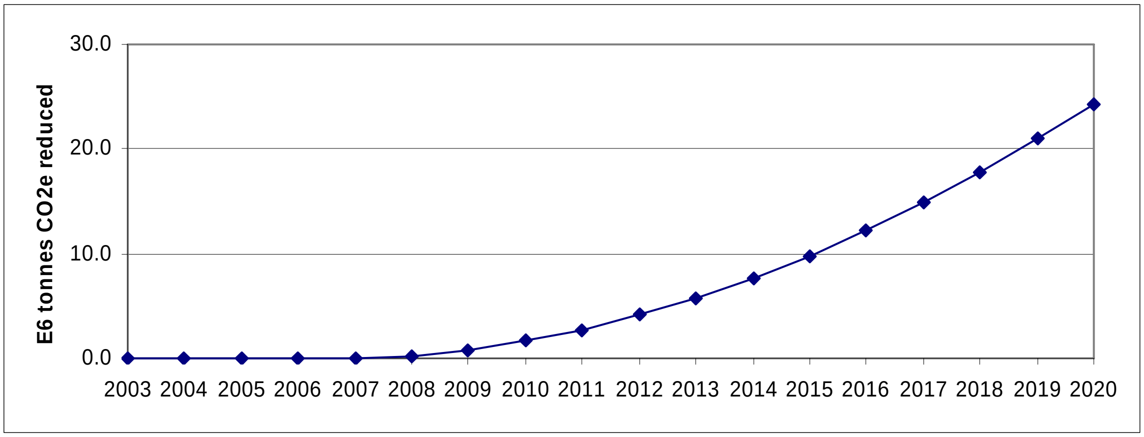
A public benefits charges would displace coal-fired generation and the therefore lead to lower CO2 emission rates in the State.

Estimated GHG Savings and Costs per $MtCO_2e$

The table below summarizes the annual GHG reductions in 2010 and 2020, the cumulative GHG reductions through 2020, the incremental cost of the option (expressed in net present value terms), and the cost-effectiveness of the option (expressed in terms of $ per ton of CO2-equivalent avoided).

		GHG Reductions (E6 tonnes CO2-equiv)				
Option No.	Option Name	2010	2020	Total (2007-2020)	NPV of Costs (E6 2005$)	Cost of Saved Carbon (2005$/tCO2 avoided)
ES-7	Public benefits charge	0.82	3.42	24.36	($685)	($28.1)

- ***Data Sources:*** EIA's Annual Energy Outlook (AEO) for 2006; RCI TWG inputs
- ***Quantification Methods:*** This analysis of this option was carried out in collaboration with the RCI who will take the initial analytical steps.
- ***Key Assumptions:*** Cost and performance characteristics of individual energy efficiency and distributed renewable options as per assumption in the RCI TWG
- ***Analytical issues:*** There were several assumptions that were made in quantifying the GHG reduction benefits and cost effectiveness of this option, as follows:
    - *Targets:* The targets for the PBF can be structured in various ways. Hence, the analysis was set up to consider the following sensitivities.
        - 1 – RCI TWG analysis: This corresponds to the total generation savings achieved by the PBF as analyzed by the RCI TWG.
        - 2 - $72 million funding target by 2020. This corresponds to a specific funding level.
        - 3 - 4,760 GWh in reductions by 2020. This corresponds to a specific generation reduction target as advanced by the CAPAG for ES analysis. **Note that this was the default assumption and the results reflect this assumption**.
    - *Marginal impact of energy efficiency:* See the discussion under ES-1. The same default assumptions were used.
    - *System CO2-equivalent emission factor:* See the discussion under ES-1. The same default assumptions were used to establish the average system emission factor. The graph below shows the cumulative CO2-equivalent emission reductions due to the PBF.



Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

ES-8 Waste to Energy

Mitigation Option Description

The combustion of waste materials or its conversion by biological or thermochemical means can be used to produce heating, cooling or electric generation with lower GHG emissions than many conventional alternatives. The waste-to-energy mitigation option focuses exclusively on Municipal Sewage Treatment (MST) to produce electricity. This is due to the fact that landfill gas (LFG), animal waste, agriculture waste, and forestry waste are all covered under the Agriculture, Forestry, and Waste Management (AFW) TWG, and direct combustion of MSW is opposed by environmental interests.

Mitigation Option Design

The policy would encourage the adoption of anaerobic digestion at MST facilities through direct subsidies to generate biogas for use in onsite engine-generators for electric power generation and heat to accelerate the treatment process. Even though the majority of generated energy will be used internally for plant operation, the municipally owned facilities should receive renewable energy credits, without having to sell the power at avoided cost and repurchasing it at retail cost

- **Goals:** 50 percent of North Carolina's new sewage treatment capacity would receive state directed funding to cover the incremental costs associated with installation and operation of on-site facilities for electrical and heat energy production from anaerobic digestion of waste sludge.
- **Timing:** Program start-up in 2008.
- **Coverage of parties:** NC Utilities Commission, Utilities, NC Sustainable Energy Assoc, Department of Environmental & Natural Resources.
- **Other:** NA

Implementation Mechanisms

This is a command/control policy requiring a regulatory framework. The listed parties need to negotiate a satisfactory agreement, which fully values the GHG reduction benefits and the advantages to both the MST facilities and the environment for this bio-based distributed generation resource.

Related Policies/Programs in Place

There are no related policies or program currently in place in North Carolina to produce electricity or heat energy from municipal sewage treatment.

Types(s) of GHG Reductions

Without upgrading existing treatment facilities, capturing 50% of the anticipated growth between now and 2020 would result in significant CO2 reductions.

Estimated GHG Savings and Costs per $MtCO_2e$

The table below summarizes the annual GHG reductions in 2010 and 2020, the cumulative GHG reductions through 2020, the incremental cost of the option (expressed in net present value terms), and the cost-effectiveness of the option (expressed in terms of $ per ton of CO2-equivalent avoided).

		GHG Reductions (E6 tonnes CO2-equiv)				
Option No.	Option Name	2010	2020	Total (2007-2020)	NPV of Costs (E6 2005$)	Cost of Saved Carbon (2005$/tCO2 avoided)
ES-8	waste-to-energy	0.00	0.02	0.13	($4)	($31.37)

- ***Data Sources:*** EIA's Annual Energy Outlook (AEO) for 2006; Waste chapter of INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2004, USEPA #430-R-06-002, (April 2006); "Estimated use of water in the United States in 1990 Wastewater Treatment Water Use" by the USGS; "Clean Energy Technologies: A Preliminary Inventory of the Potential for Electricity Generation" by Owen Bailey and Ernst Worrell, LBNL-57451, April 2005
- ***Quantification Methods:*** Incremental cost of waste to energy systems will be estimated relative to the most likely capacity they would displace on the system.
- ***Key Assumptions:*** TBD
- ***Analytical issues:*** There were several assumptions that were made in quantifying the GHG reduction benefits and cost effectiveness of this option, as follows:
  - *Technical Capacity:* Technical capacity associated with municipal waste was estimated at 12.8 MW based on the USGS[2] estimate of 546 wastewater treatment public facilities in NC; a net public return flow of 562 million gallons per day (also from USGS); and an assumption of 22.7 MW per million gallon/day from Bailey and Worrel.[3]
  - *Targets:* A sensitivity analysis was set up to consider the following:
    - 1 – Mid capacity target of 50% of the technical capacity by 2020. **Note that this was the default assumption and the results reflect this assumption.**.
    - 2 – Low capacity target of 20% of the technical capacity by 2020.
    - 3 – High capacity target of 100% of the technical capacity by 2020.
  - *Marginal impact of energy efficiency and renewable generation:* See the discussion under ES-1. The same default assumptions were used.
  - *System CO2-equivalent emission factor:* See the discussion under ES-1. The same default assumptions were used. The graph below shows cumulative CO2-equivalent emission reductions after the introduction of the waste to energy systems. The emission reductions account for the methane emissions that would otherwise be emitted to the atmosphere through anaerobic digestion.

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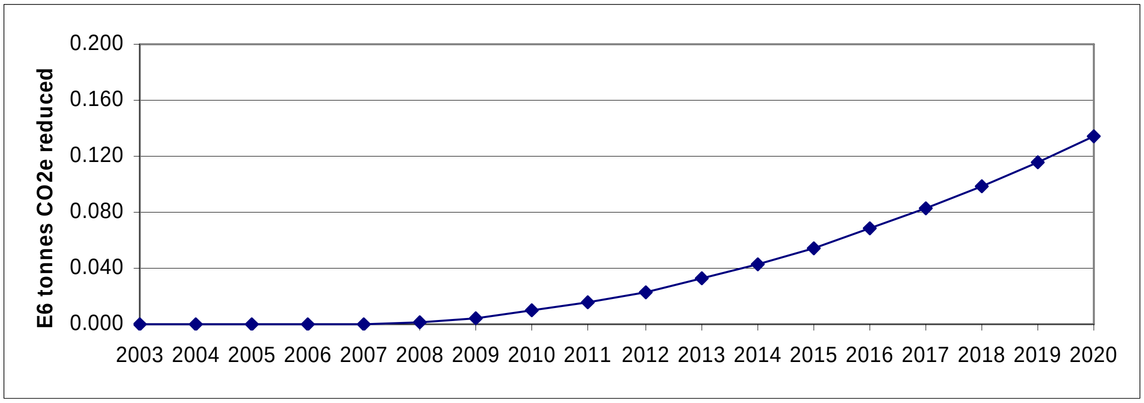
[2] Table 30 of "Estimated use of water in the United States in 1990 Wastewater Treatment Water Use" by the USGS

[3] "Clean Energy Technologies: A Preliminary Inventory of the Potential for Electricity Generation" by Owen Bailey and Ernst Worrell, LBNL-57451, April 2005



Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

ES-10 NC GreenPower Renewable Resources Program

Mitigation Option Description

NC GreenPower is an independent, nonprofit organization established to improve North Carolina's environment through voluntary contributions toward renewable energy. The goal of NC GreenPower is to supplement the state's existing power supply with more green energy – electricity generated from renewable resources like the sun, wind and organic matter. The program accepts financial contributions from North Carolina citizens and businesses to help offset the cost to produce green energy. NC GreenPower differs from a Renewable Portfolio Standard (RPS) in that the RPS requires that electric utilities provide a certain level of renewable energy capacity in their generation mix. NC GreenPower is entirely voluntary, with the revenue going toward paying incremental costs of renewable energy generation. Also, because all power purchased through NC GreenPower is produced inside the state, there are also economic development benefits.

Mitigation Option Design

This policy aims to increase the effectiveness of the existing NC GreenPower program through a set of demand- and supply-side recommendations, as follows:

Demand-Side Recommendations	Supply-side Recommendations
State facilities mandated to purchase a certain percentage of their power through NC GreenPower	Support for R&D on new and developing renewable energy technologies.
Provide incentives for new or expanding businesses to purchase NC GreenPower	Provide support for feasibility studies of various renewable energy technologies.
Provide tax credits for companies purchasing from NC GreenPower or who enable employees to do.	Provide a mechanism for long-term contract guarantees for renewable energy producers.
Provide incentives for home builders to include one year of green energy through NC GreenPower with the purchase of new homes.	Provide support for larger renewable energy development projects, thereby leading to more options and sales tools.
Provide assistance and participation in consumer and business marketing programs.	Ease ridge laws in the mountains to allow for wind energy development; work with the military for wind energy in coastal areas currently blocked
The should Work with the USEPA (through NCDENR) to ensure NC GreenPower is an option for air quality (AQ) violator restitution.	Provide low or no interest loans for qualified developers of renewable energy projects.
Ensure that AQ benefits of NC GreenPower are wedded to other benefits such as waste reduction, greenhouse gas emission reductions, and economic development	

- **Goals:** All of North Carolina's state facilities would purchase at least 10% of their power from NC GreenPower.
- **Timing:** Program start-up in 2008.
- **Coverage of parties:** NC Utilities Commission, Utilities, NC Sustainable Energy Assoc, Department of Environmental & Natural Resources.

- **Other:** NA

Implementation Mechanisms

This is a command/control policy requiring a regulatory framework. The listed parties need to negotiate a satisfactory agreement, which fully values the GHG reduction benefits and the advantages to both the MST facilities and the environment for this bio-based distributed generation resource.

Related Policies/Programs in Place

There are no related policies or program currently in place in North Carolina to produce electricity or heat energy from municipal sewage treatment.

Types(s) of GHG Reductions

Without upgrading existing treatment facilities, capturing 50% of the anticipated growth between now and 2020 would result in significant CO2 reductions.

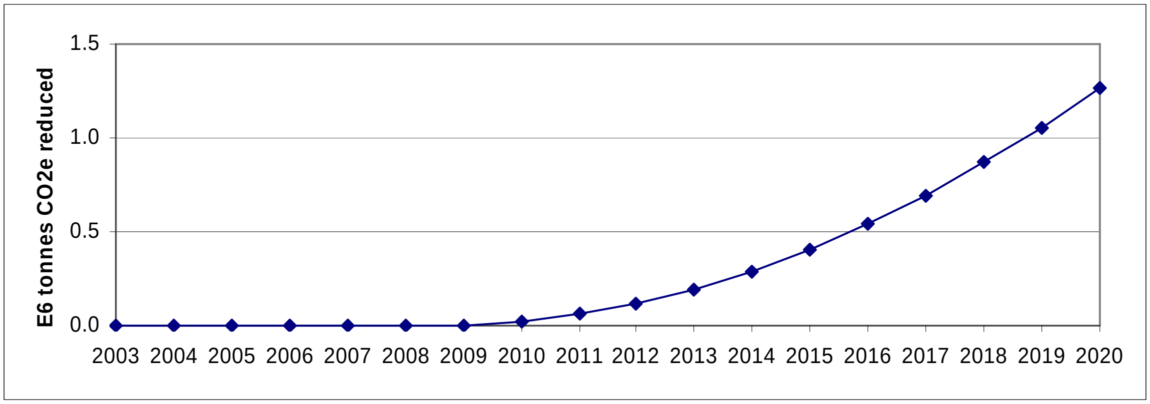
Estimated GHG Savings and Costs per $MtCO_2e$

The table below summarizes the annual GHG reductions in 2010 and 2020, the cumulative GHG reductions through 2020, the incremental cost of the option (expressed in net present value terms), and the cost-effectiveness of the option (expressed in terms of $ per ton of CO2-equivalent avoided).

		GHG Reductions (E6 tonnes CO2-equiv)				
Option No.	Option Name	2010	2020	Total (2007-2020)	NPV of Costs (E6 2005$)	Cost of Saved Carbon (2005$/tCO2 avoided)
ES-10	strengthening the NC Greenpower program	0.02	0.21	1.26	$10	$7.9

- ***Data Sources:*** EIA's Annual Energy Outlook (AEO) for 2006; RCI TWG inputs
- ***Quantification Methods:*** This analysis of this option will be carried out in collaboration with the RCI who will take the initial analytical steps.
- ***Key Assumptions:*** Cost and performance characteristics of individual energy efficiency and distributed renewable options as per assumption in the RCI TWG
- ***Analytical issues:*** There were several assumptions that were made in quantifying the GHG reduction benefits and cost effectiveness of this option, as follows:
  - *Targets:* The targets were defined relative to the total generation needed to meet state demand for electricity (i.e., 2,890 GWh in 2020). It was assumed that the target is achieved entirely with renewable energy. The analysis was set up to consider two sensitivities, as follows:
    - 1 – RCI TWG analysis: This corresponds to a 10% target (relative to projected state demand for electricity) achieved by 2017 and remaining constant thereafter. **Note that this was the default assumption and the results reflect this assumption.**.
    - 2 - This corresponds to 10% target (relative to projected state demand for electricity) achieved by 2020.

- *Marginal impact of energy efficiency:* See the discussion under ES-1. The same default assumptions were used.
- *Renewable energy mix:* See the discussion under ES-1. The same default assumptions were used.
- *System CO2-equivalent emission factor:* See the discussion under ES-1. The same default assumptions were used to establish the average system emission factor. The graph below shows the cumulative CO2-equivalent emission reductions due to the strengthened GreenPower program.



Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD