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

Table x.
Agriculture, Forestry, and Waste Management Technical Work Group
Summary List of Mitigation Options

	Mitigation Option	GHG Reductions ($MMtCO_2e$) 2010	GHG Reductions ($MMtCO_2e$) 2020	GHG Reductions ($MMtCO_2e$) Total 2007-2020	Net Present Value 2007–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
	AGRICULTURE, FORESTRY, AND WASTE MANAGEMENT						
AFW-1	Manure Digesters & Energy Utilization	0.2	0.9	6.3	387	67	TBD
AFW-2	Biodiesel Production (incentives for feedstocks and production plants)						TBD
AFW-3	Soil Carbon Management						TBD
AFW-4	Preserve Agricultural Land						TBD
AFW-5	Agricultural Biomass Feedstocks for Electricity or Steam Production						TBD
AFW-6	Policies to Promote Ethanol Production						TBD
AFW-7	Forest Protection – Reduced Clearing and Conversion to Nonforest Cover						TBD
AFW-8	Afforestation and/or Restoration of Nonforested Lands						TBD
AFW-9&10	Expanded Use of Forest Biomass and Better Forest Management						TBD
AFW-11	Landfill Methane and Biogas Energy Programs	0.2	1.9				TBD
AFW-12	Increased Recycling Infrastructure and Collection						TBD
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS						
	REDUCTIONS FROM RECENT ACTIONS (table to be added below)						
	SECTOR TOTAL PLUS RECENT ACTIONS						

AFW-1. Manure Digesters & Energy Utilization

Mitigation Option Description

The methane emissions inherent from the anaerobic decomposition process of manure and other wastes may be captured and used as an energy source. In so doing, it is possible to both reduce methane emissions and to offset fossil-based energy. However, the cost of emission capture and energy production can be higher than the value of the energy collected, making this option cost prohibitive for producers operating in a tight margin business. This option covers programs to increase the number of methane capture and energy recovery projects using manure or other waste (including food processor waste).

Mitigation Option Design

Provide economic incentives / cost offsets for producers interested in manure to energy projects.

- **Goals:** Capture 20% of available methane from confined animal operations by 2020 for use in energy projects.
- **Timing:** By 2010, implement projects to capture 5% of available methane energy at confined animal operations. By 2020, implement projects to capture 20% of methane energy.
- **Coverage of parties: ?**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

- Education of opportunities for farmers from NRCS & NCCES (including technical assistance).
- Incentives in the form of tax breaks (sales and/or income) for incurred capital costs.
- Inclusion in voluntary programs such as NC Green Power and NC Agriculture Cost Share. Increased funding from General Funds.
- Increased research to improve return on investment for digesters.
- Education for farmers of power purchase agreements and interconnection with the grid.

Related Policies/Programs in Place

- NRCS cost share program.
- NC Renewable Energy Property tax credit. State income tax credit for 35% of construction costs not to exceed $2.5M or 50% of tax burden.
- EPA AgStar Program.
- Federal Renewable Electricity Production Tax Credit.

Types(s) of GHG Reductions

- CH4 – methane is captured and typically combusted in an energy recovery system or flare. Small amounts of N2O and CH4 are emitted from the combustion process.
- CO2 – carbon dioxide is reduced when the methane is converted to energy and that energy is used to offset fossil-based energy (e.g. electricity, natural gas, etc.). Small amounts of N2O and CH4 are also reduced from the fossil-based energy that is offset.

Estimated GHG Savings and Costs per $MtCO_2e$

- **GHG reduction potential in 2010, 2020 (MMtCO2e):** 0.2, 0.9
- **Net Cost per MtCO2e:** TBD
- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

- Possible nutrient management benefits.
- Economic benefits of digester industry.

Feasibility Issues

- Currently a very long return on investment.
- Demand from electric utilities.

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-2. Biodiesel Production (incentives for feedstocks and production plants)

Mitigation Option Description

Use of biodiesel offsets the consumption of diesel fuel produced from oil (fossil diesel). Since biodiesel has a lower GHG content than fossil diesel, overall GHG emissions are reduced. By producing biodiesel in the state for consumption within the state, the highest benefits can be achieved, since the fuel is transported over shorter distances to the end user. This option covers incentives needed to increase biodiesel production in North Carolina.

Mitigation Option Design

[Insert text as appropriate]

- **Goals:** Produce enough biodiesel to offset 12.5% of NC's fossil diesel consumption by 2020.
- **Timing:** By 2010, produce enough biodiesel to offset 5% of fossil diesel consumption. By 2020, produce enough biodiesel to offset 12.5% of in-state fossil diesel consumption.
- **Coverage of parties:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

- Incentives in the form of tax breaks (sales and/or income) for incurred capital costs.
- Streamlined permitting of production facilities. Technical assistance for new producers.
- Active solicitation of new producers.
- Expanded consumer education to drive demand.
- Expanded producer education to develop skilled workforce.

Related Policies/Programs in Place

- NC Renewable Energy Property tax credit. State income tax credit for 35% of construction costs not to exceed $2.5M or 50% of tax burden.
- Federal Biodiesel Mixture Tax Credit. Federal excise tax credit for biodiesel mixtures, ranges from $.50 to $1.00/gallon depending on feedstock.

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per $MtCO_2e$

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**

- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

- Additional markets for oilseed crops and animal fats.
- Economic growth from locally produced fuels.

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-3. Soil Carbon Management

Mitigation Option Description

Use of conservation tillage/no-till and other soil management practices can increase the level of organic carbon in the soil, which sequesters carbon dioxide. In addition, some practices lower fossil fuel consumption through less intensive equipment use. Other practices, such as the application of bio-char can also increase the level of soil carbon and improve the soil. This option is designed to increase the acreage using soil management practices that lead to higher soil carbon content.

Mitigation Option Design

- **Goals:** *By 2020, apply soil management practices on 50% of cultivated lands that currently do not use these techniques.*
- **Timing:** *By 2010, apply conservation tillage/no-till methods on 20% of acres that currently do not use these practices. Achieve an increase to 50% of these acres by 2020.*
- **Coverage of parties:** NC Department of Agriculture, NC DENR, NCSU (CALS, CNR), NC Extension, other agricultural organizations and associations
- **Other:** *Studies in NC have found the potential to sequester one ton of carbon per acre through conservation tillage/no-till practices*[1] *(equivalent to about 3.3 MtCO2e/acre).*

Implementation Mechanisms

- Increase NC Agriculture Cost Share funding to include additional acreage in no-till.
- Continue educational programs through NCCES.
- Research the availability and effectiveness of bio-char application.

Related Policies/Programs in Place

- NC Agriculture Cost Share for no-till.
- NRCS cost share programs.

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per $MtCO_2e$

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**

[1] Source: http://southeastfarmpress.com/news/030106-Naderman-conservation/.

- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

- Reduced soil erosion for no-till.

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-4. Preserve Agricultural Land

Mitigation Option Description

Reduce the rate at which existing crop and pasture are converted to developed uses. The carbon sequestered in soils and aboveground biomass is much higher in croplands than in developed land uses. Policies are needed to preserve working farms and forests (see AFW-7) from unwise and unplanned development.

Mitigation Option Design

State and national programs have been established to protect farm communities from conversion to development. Funding state farmland preservation programs will help meet goals and act as a needed match to national programs. Programs are being investigated that help farmers transition lands to beginning farmers.

- **Goals:** Reduce the rate at which agricultural lands are converted to developed use by 50% by 2020 from current levels.
- **Timing:** By 2010, reduce the rate of conversion by 20% from current levels. By 2020, reduce the rate of conversion by 50%.
- **Coverage of parties:** NCDA&CS, NC Farm Bureau, NCDF, USDA-FS, NCFR, NCSU, NC Farm Transition Network
- **Other:** North Carolina lost 2000 farms and 100,000 acres between 2004-2005. North Carolina has lost over 7 thousand farms and 300,000 acres since 2000.

Implementation Mechanisms

- Increased funding for state farmland preservation programs.
- Increased public education on the benefits of preserving agricultural land.
- Inclusion in voluntary programs such as NC Agriculture Cost Share. Increased funding from General Funds.

Related Policies/Programs in Place

- Existing farmland preservation programs.

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per $MtCO_2e$

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**

- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-5. Agricultural Biomass Feedstocks for Electricity or Steam Production

Mitigation Option Description

Offset fossil fuels use with agricultural biomass as feedstock for electricity, steam, or heat generation. Agricultural biomass includes, but is not limited to, poultry litter, livestock manure, and crop residues. Offsetting fossil fuels use reduces the GHG emissions associated with these fuels.

Mitigation Option Design

- **Goals:** Increase agricultural biomass use for electricity, steam, and heat generation to utilize 10% of available biomass by 2010, 25% of available biomass by 2020 and 50% of available biomass by 2030. Voluntary, incentive based programs should be used to foster development of the industry and associated economic markets.
- **Timing:** See above.
- **Coverage of parties:** NCDA&CS, NCSU, NCA&T, Cooperative Extension, NC State Energy Office, DAQ, Utilities Commission, Electric Utilities, Livestock & Poultry Producers, Crop Producers.
- **Other:** Explore biomass utilization from electricity, steam, and heat generation using 100% biomass and/or co-firing with other feedstocks.

Implementation Mechanisms

- Incentives in the form of tax breaks (sales and/or income) for incurred capital costs.
- Inclusion/Expansion of voluntary programs such as NC Green Power and NC Agriculture Cost Share.
- Increased research to improve return on investment.
- Education for potential producers of power purchase agreements and interconnection with the grid.
- Public education of benefits of electricity produced from biomass, drive demand.

Related Policies/Programs in Place

- NC Renewable Energy Property tax credit. State income tax credit for 35% of construction costs not to exceed $2.5M or 50% of tax burden.
- Federal Renewable Electricity Production Tax Credit.
- NC Green Power.

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per $MtCO_2e$

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

- Additional markets for agricultural biomass.
- Economic growth from electricity produced from local feedstocks, rural economy benefits.

Feasibility Issues

- Demand from electric utilities.

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-6. Policies to Promote Ethanol Production

Mitigation Option Description

Offset fossil fuel use (gasoline) with production and use of starch-based and cellulosic ethanol. Offsetting gasoline use with ethanol can reduce GHGs to the extent that the ethanol is produced with lower GHG content. Provide incentives for the production of ethanol from crops, forest sources, animal waste, and municipal solid waste.

Mitigation Option Design

- **Goals:** Several projects are being proposed that would result in the production of 150 million gallons of ethanol annually in North Carolina by 2008. Incentives could increase this amount to a volume equivalent to offsetting gasoline consumption in the state by 10% in 2015 and 25% by 2025. These goals are based on cellulosic ethanol being commercially viable by 2015.
- **Timing:** See above.
- **Coverage of parties:** NCDA&CS, Department of Administration, Motor Carrier Enforcement Division, DENR, Department of Commerce, NC Rural Center, NCSU, NCA&T, other state agencies, agricultural associations which represent producers of feedstock, petroleum industry trade groups, and various industry and forestry associations.
- **Other:** Identify incentives that encourage the growing of feedstocks, production of ethanol in North Carolina, and the utilization of ethanol all across the state.
    - Consider impact of expected increases in transportation costs on delivery of feedstocks to processing facilities, and how this effects optimal distribution of production infrastructure.

Implementation Mechanisms

- Incentives in the form of tax breaks (sales and/or income) for incurred capital costs.
- Streamlined permitting of production facilities. Technical assistance for new producers.
- Active solicitation of new producers.
- Expanded consumer education to drive demand.
- Expanded producer education to develop skilled workforce.
- Expanded research for cellulosic ethanol production.

Related Policies/Programs in Place

- NC Renewable Energy Property tax credit. State income tax credit for 35% of construction costs not to exceed $2.5M or 50% of tax burden.
- Federal Ethanol Mixture Tax Credit, currently $.50/gallon.

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per $MtCO_2e$

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

- Additional markets for starch/sugar crops and possibly dedicated energy crops.
- Economic growth from locally produced fuels.

Feasibility Issues

- Feedstock supply for corn based ethanol production.

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-7. Forest Protection – Reduced Clearing and Conversion to Nonforest Cover

Mitigation Option Description

Reduce losses of forested lands and their carbon sequestration potential to development or poor forest management. Developed areas contain lower amounts of biomass and its associate carbon. These areas also sequester less carbon dioxide than forested areas.

Mitigation Option Design

North Carolina is losing on average 61,390 acres of productive forest each year over the last 30 years to development and a lack of regeneration post-harvest. This amounts to a loss of about 10% since 1974, or about 0.36% annually compounded loss.

- **Goals:** Reduce the rate of conversion by 10% by 2010 and 25% by 2020.
- **Timing:** see above
- **Coverage of parties:** NC Division of Forest Resources, NC Extension, NCSU College of Natural Resources, NC Forestry Association, NC Woodlands
- **Other:** The loss of forested lands is not consistent; between 1984 and 1990, there was actually an increase in the timberland area of 260,000 acres. This offers hope that one might reverse the overall trends in forest losses.

Implementation Mechanisms

- Use valuation, perhaps subsidize where use value is same as commercial value
- Higher value to forestry, see AFW 9 & 10
- Economic inducements to not harvest in priority zones.

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per $MTCO_2e$

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-8. Afforestation and/or Restoration of Nonforested Lands

Mitigation Option Description

Afforest nonforested lands or restore degraded habitats to forests in order to sequester and store carbon above pre-existing conditions. Existing afforestation programs are underfunded for the task of this afforestation, typically there is a long wait list for landowner forestation projects. This option covers the provision of additional incentives to increase the rate of afforestation and restoration.

Mitigation Option Design

[Insert text as appropriate]

- **Goals:** Initiate afforestation/restoration projects on 540,000 acres by 2020.
- **Timing:** By Fall 2007 planting season have candidate acreage identified (by county) in cooperation with NRCS, FSA and NC SWCD and NC DFR[2]. By 2010, achieve afforestation projects on 40,000 acres. Achieve a total of 540,000 acres of afforestation projects by 2020.
- **Coverage of parties:** Seek to establish a unified cooperative alliance of farm (NC Farm Bureau), forest landowner (North Carolina Woodland Owners Association, North Carolina Forestry Association)**,** agencies (NC DFR, NC DA), utilities (Duke, Progress Energy), industrial and non-governmental organizations to promote and implement the coordination needed to reach this historic goal.
- **Other:** Afforestation, the planting of trees on lands that have not recently supported forests, has both carbon sequestration and other environmental benefits: storing up to two tons of carbon per acre each year (7.3 tons of CO_2, on-site, not including off-site storage and offsets in products); deliver other important benefits such as improved wildlife habitat, reduced soil erosion and fertilizer runoff, and new recreational opportunities. There is a large opportunity for afforestation on agricultural, brownfields, and other lands in NC (possibly greater than 1.5 million acres).[3] These lands are relatively productive for forestry, as the croplands have typically been previously fertilized with mineral nutrients. The average cost-sharing for forestation success in the NC Forest Development Program (FDP) averages between $90 and $200 per acre[4]. The FDP has been the major funding mechanism for state assistance to landowners foresting their lands (~90% of all acres cost

[2] Natural Resources Conservation Service & Farm Services Agency (USDA), North Carolina Soil and Water Conservation Districts and Division of Forest Resources

[3] Conservation Compliance: the Clock is Running. Cook, M. and D. Hoag. 1997 SoilFacts , AG-439-23 http://www.soil.ncsu.edu/publications/Soilfacts/AG-439-23/ Accessed 10/3/2006.

[4] Forest Development Program, Annual Accomplishment Summary, 2006, Joann Hocut, NC Division of Forest Resources.

shared by currently active NCDFR administered forestation programs, see Figure below[5]) and has reached approximately 85% of NIPF landowners doing forestation over the last 6 years (1999-2005)[6].

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per $MTCO_2e$

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

[5] Ibid.
[6] Chris Hopkins' synthesis of Forest Statistics for North Carolina, 2002 and FDP reports.

AFW-9 & 10. Expanded Use of Forest Biomass and Better Forest Management

Mitigation Option Description

Direct the products of forest management to the highest value markets that currently exist and the currently unmarketable logging residue, culls and saplings to the appropriate processing centers for electricity, heating or liquid fuels. Offsetting fossil fuel use reduces GHG emissions. Increase the growth and yield of production from sustainably managed forest resources through site preparation, competition control, thinning, fertilization, and improved genetics. These practices will increase the amount of carbon stored in forested areas and increase carbon dioxide sequestration rates.

Mitigation Option Design

The goal is the expansion of the production and use of wood products for solid wood products, fiber and fuel. The use of each of these offsets the use of fossil fuels in the production of substitute material (cement, steel for solid wood products, plastic for wood fiber) or directly in the case of fossil fuels for biomass energy. Having a market for relatively low value biomass products enables forest management for higher value solid wood products (see Additional Benefits and Costs section below for more background).

- **Goals:** Initiate programs to increase forest productivity by 100% on half of NC timberlands by 2020.
- **Timing:** Begin 2007 and increase to full implementation of management programs on 50% of timberlands by 2020. Increase coverage to all managed timberlands by 2030.
- **Coverage of parties:** Division of Forest Resources, NC Extension, NCSU College of Natural Resources, NC Forestry Association, NC Woodlands
- **Other:** Increased benefits from forest management would increase forestland owner incomes and the probability of retaining forest cover.

Implementation Mechanisms

Below are some ideas for discussion, I am not committed to anyone:

- A renewable portfolio standard (depending on how it was defined) could generate a market for forest biomass, likewise some
- state incentive for cellulosic biomass to ethanol plant.
- A state carbon tax could incentivise renewable fuel production (liquid and electricity) and encourage the use of durable wood products over steel and concrete. The largest emitters of CO2 (coal, liquid fuels, concrete, etc.) could be taxed on their emissions of fossil carbon. The funds could be allocated to carbon sequestration efforts in which forestry could compete cost effectively. FDP might be the mechanism to allocate carbon tax funds.

- Perhaps the state could participate in carbon trading and retain the carbon credits for any state funded carbon sequestration on private land through FDP.

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per $MTCO_2e$

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

The goal is to double the productivity of timberland for high value products and claim these products and energy as carbon offsets. We estimate that 1.75% (~57 year rotation) of the state timberland (totaling 17.6 million acres) is cut each year, so most timberland is currently under some sort of management, although much of it is of a very low intensity, indeed 25% of harvested stands continue to be high-graded. Our goal is to improve the management and productivity of these lands, especially on the 11.4 million acres held by non-industrial private forest land owners.

A standard application of fertilizer on otherwise unmanaged land can increase average productivity about 66% for hardwood and 77% for softwoods. Improved genetics continues to add 5 to 10% in productivity for each improved generation. Improved thinning and competition control can increase high value product growth by 20%. The logging residue that currently is left in the woods is about 15% of total productivity and this too would be increased by fertilization and could be used for biomass energy. While not all improvements are directly multiplicative, it is clear that we can double forest productivity and more than double carbon sequestration by forests in North Carolina.

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-11 Landfill Methane and Biogas Energy Programs

Mitigation Option Description

Provide incentives that will result in an increase in the recovery of landfill methane for use as an energy source. Increasing the recovery of landfill methane will reduce emissions of this GHG and will offset the use of fossil fuels for commercial/industrial heat/steam generation or electricity production.

Mitigation Option Design

Out of approximately 130 open and closed landfills in the state, only about 15 sites are currently recovering landfill methane for energy use.

- **Goals:** Increase the number of landfills recovering methane as an energy source, such that 50% of the landfill gas being generated is controlled by 2020. This can be done through development of additional landfill gas to energy (LFGTE) projects. For sites where LFGTE is not feasible, implement flaring controls to achieve the goal.
- **Timing:** By 2010, implement LFGTE at 10 sites not currently using these technologies; by 2020, achieve full implementation of the policy (50% coverage of generated LFG).
- **Coverage of parties:** Municipal and county governments, private solid waste management companies, local economic development agencies, NC Department of Environment and Natural Resources, NC Department of Commerce, NC Utilities Commission, non-government organizations, and public interest groups.
- **Other:** No distinction is made between the direct use of landfill methane (e.g. for heat or steam) and the use of methane for electricity generation.

Implementation Mechanisms

Undertake a GIS based assessment of landfill gas to energy project potentials focusing on identifying end-users (may have been undertaken by NC Solar Center and State Energy Office). Work with the NC Department of Commerce to use the findings for economic development purposes.

Establish and expand tax credits for the development of landfill gas to energy projects.

Develop policies that encourage state agencies to enter into fuel/power purchasing agreements that will result in increased landfill gas to energy projects.

Research the potential to alleviate burdens associated with the NC Utilities Commission rules regarding the treatment of landfill gas to energy projects as regulated utilities.

Develop a grant program or other incentives to encourage the installation of gas collection systems at landfills for the purpose of flaring landfill methane.

Related Policies/Programs in Place

NC State Energy Office, NC DENR, NC Solar Center, US EPA – Landfill Methane Outreach Program.

US Department of Energy, Renewable Energy Production Incentive; US Internal Revenue Code, Section 45; 15 NCAC 13B Section .1500, Standards for Special Tax Treatment of Recycling and Resource Recovery Equipment and Facilities.

Types(s) of GHG Reductions

Methane Destruction – Flaring or production of energy from landfill gas results in the destruction of methane.

GHGs Reduced via Fossil Fuel Reductions – Use of landfill gas for generating heat/steam or electricity can offset fossil fuel use (e.g. natural gas, coal), which will reduce emissions of CO_2, CH_4, and N_2O from the combustion of fossil fuels.

Estimated GHG Savings and Costs per $MtCO_2e$

- GHG potential in 2010, 2020 (MMtCO2e): 0.4, 1.9
- Net Cost per MtCO2e: TBD
- **Data Sources:** The NC GHG Inventory & Forecast was used as the source of data on available methane emissions.
- **Quantification Methods:** GHG savings were estimated by determining the CO_2 equivalent for the available methane to be reduced in 2010 (20%) and 2020 (50%) at uncontrolled landfills in the state.[7] Additional GHG reductions could be achieved by capturing and utilizing methane at flared sites; however these were not included in the estimates below. A portion of the benefit was estimated by converting the appropriate fraction of available methane into CO_2e in each year. The other portion of the benefit was estimated by assuming that the methane used would offset use of an equivalent amount (on a heat basis) of natural gas. The emissions associated with this amount of natural gas were added to the benefit for reducing methane emissions to arrive at the total benefit.

  The cost estimate was estimated from…

- **Key Assumptions:** For this analysis, available methane means 75% of the methane emitted at uncontrolled landfills which is the assumed amount that can be captured for energy use. In 2010, projects are implemented to capture 5% of the available methane; in 2020 this rises to 50%.

Key Uncertainties

[7] The 20% value in 2010 is assumed based on the goal of implementing projects at 10 of about 100 uncontrolled sites. These first sites are likely to be implemented at the largest (highest producing) sites. Based on emissions modeling conducted by CCS during the development of the Inventory & Forecast, implementing projects at 10 of the largest uncontrolled sites would cover at least 20% of the waste in place at these sites and the potential methane emissions.

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

The practice of locating landfills in very rural areas often results in a lack of viable local end users. Furthermore, the possible treatment as a regulated utility can also prevent landfill gas to energy projects from being developed.

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-12 Increased Recycling Infrastructure and Collection

Mitigation Option Description

Increase the quantity of materials recovered for recycling with specific attention given to materials with the greatest ability to reduce energy consumption during the manufacturing process and to materials that may be used as a fuel source (e.g., clean wood waste). Reducing the quantify of materials being landfilled reduces future landfill methane emissions potential, while recycling reduces emissions associated with the manufacturing of products from raw materials.

Mitigation Option Design

- **Goals:** Increase per capita recovery in the state 25% by 2020.
- **Timing:** Achieve a 10% increase in per capita recovery by 2010 and a 25% increase in per capita recovery by 2020.
- **Coverage of parties:** Municipal and county government, private solid waste and recycling management companies, commercial, industrial and institutional generators, NC Department of Environment and Natural Resources.
- **Other:** For the purpose of calculating per capita recovery, yard waste (yard trash as defined in G.S. 130A-290) and other vegetative debris are not included. Yard waste is banned from disposal in MSW and C&D landfills and experiences large annual fluctuations in both generation and recovery.

Implementation Mechanisms

Numerous options exist for increasing recovery in the state. These options should be thoroughly researched to determine the effectiveness of the various options.

Expand statewide waste reduction education campaigns to include the GHG mitigation benefits of increased waste reduction.

Research the feasibility and impacts of implementing statewide disposal bans for corrugated cardboard and clean wood waste. Make recommendations based on findings.

Conduct extensive research into increased food waste diversion covering at a minimum - infrastructure needs, barriers to increasing infrastructure, incremental cost of food waste diversion and potential climate change benefits of food waste diversion. Make recommendations based on findings.

Provide technical assistance to local governments on operating more effective recycling programs (ongoing).

Lead by example for state agencies? -

Legislative actions:

- Require any new host community agreements between a landfill developer and any local government to include provisions for a minimum prescribed level of recycling services within a maximum allowable service area per recycling drop-site.
- In lieu of, or in addition to existing local per capita waste reduction goals, require local government 10-year solid waste solid waste management plans to include an enforceable per capita recovery goal that increases annually until 2020. Enforceability may be achieved by requiring local governments to take specific actions to improve performance if goals are not met. An initial minimum recovery rate would have to be determined.
- Increase funding to the NC Solid Waste Management Trust fund for increased grants to local governments and to private sector for additional infrastructure expansion.

Related Policies/Programs in Place

State Solid Waste Management Trust Fund, NC DPPEA – Community Waste Reduction and Recycling Grants, Recycling Business Development Grants; Local Government Assistance Team, NC DPPEA; Recycling Business Assistance Center, NC DPPEA.

GS 130A-309.10(f) and (f1) – Materials Banned from Disposal and Incineration

GS 130A-309.09A – Local Government Solid Waste Responsibilities

Types(s) of GHG Reductions

Landfill Methane – Reducing the quantity of organic material entering the anaerobic environments found in landfills will result in a decrease in methane gas releases from landfills.

Upstream Energy Use Reductions – Less energy is generally required to manufacture goods from recycled feedstocks than from virgin feedstocks. For example, the addition of recycled glass cullet to the glass making process allows manufacturers to operate furnaces at lower temperatures.

Estimated GHG Savings and Costs per $MTCO_2e$

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

Some legislative action would be required (see Implementation Mechanisms section). Some infrastructure development might be required.

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]