



**Agriculture, Forestry, and Waste Management Technical Work Group
Summary List of Draft Priorities for Analysis**

Proposed Option #	Proposed Option Name	# From Catalog of States Actions
AFW-1	Agricultural Crop Management	3.1-3.3, 3.6, 2.1, 5.2
AFW-2	Manure Management and Energy Utilization	1.1, 2.2, 2.3
AFW-3	Reductions in On-Farm Energy Use	5.4
AFW-4	Biodiesel Production	1.2
AFW-5	Ethanol Production	1.4
AFW-6	Preserve Lands with Carbon Storage Value	4.2, 4.3, 6.1
AFW-7	Biomass Feedstocks for Energy Production	1.3, 8.1, 8.2
AFW-8	Forestry Programs to Enhance GHG Benefits	6.5, 6.7, 6.11-6.13, 7.2
AFW-9	Prevent Landfilling of Unprocessed Organic Material	9.6
AFW-10	Landfill Methane Energy Programs	8.5, 10.2, 10.3

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

	Mitigation Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2007–2020 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2012	2020	Total 2007–2020			
	AGRICULTURE, FORESTRY, AND WASTE MANAGEMENT						
AFW-1	Agricultural Crop Management						TBD
AFW-2	Manure Management and Energy Utilization						TBD
AFW-3	Reductions in On-Farm Energy Use						TBD
AFW-4	Biodiesel Production						TBD
AFW-5	Ethanol Production						TBD
AFW-6	Preserve Lands with Carbon Storage Value						TBD
AFW-7	Biomass Feedstocks for Energy Production						TBD
AFW-8	Forestry Programs to Enhance GHG Benefits						TBD
AFW-9	Prevent Landfilling of Unprocessed Organic Material						TBD
AFW-10	Landfill Methane Energy Programs						TBD
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS						
	REDUCTIONS FROM RECENT ACTIONS (table to be added below)						
	SECTOR TOTAL PLUS RECENT ACTIONS						

AFW-1. Agricultural Crop Management

Mitigation Option Description

The amount of carbon stored in the soil can be increased by the adoption of conservation tillage. Reducing mechanical soil disturbance reduces the oxidation of soil carbon compounds and allows more stable aggregates to form. Other benefits of conservation tillage include reduced wind and water erosion, reduced fuel consumption, and improved wildlife habitat. Additional crop management methods that can be used to increase the levels of soil carbon include reducing summer fallow, increasing winter cover crops, and application of biochar.

Other crop management methods can reduce GHG emissions by improving the efficiency of fertilizer use (reduction in nitrous oxide emissions and potentially fossil fuel use) and education and outreach technical services for farmers to adopt practices that are less GHG-intensive. For some production systems, organic farming practices result in lower net GHG emissions.

Mitigation Option Design

Goals: Establish GHG-beneficial crop management practices on XX acres by 2020.

Timing: Achieve GHG-beneficial crop management practices on XX acres by 2012; achieve the full goal by 2020.

Coverage of parties:

Other:

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

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

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

AFW-2. Manure Management and Energy Programs

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. Methane and nitrous oxide emissions can occur at several different places in the manure management process. Management techniques can also reduce GHG emissions and, with energy recovery, offset fossil-based energy. This option covers producer incentives to adopt programs to increase the number of methane capture and energy recovery projects or other manure management techniques that reduce methane and nitrous oxide emissions.

Mitigation Option Design

Goals: *Implement manure management and energy programs XX% of confined animal operations (CAOs) by 2020.*

Timing: *Implement programs on XX% of CAOs by 2012; achieve the full goal by 2020.*

Coverage of parties:

Other:

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

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

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

AFW-3. Reductions in On-Farm Energy Use

Mitigation Option Description

This option seeks to develop and implement cost effective programs for renewable energy and energy efficiency technologies for farmers and ranchers. Reductions in fossil fuel consumption reduce emissions of carbon dioxide, methane, nitrous oxide, and black carbon.

Mitigation Option Design

Goals: From a 2005 baseline measure of agriculture energy consumption, seek to reduce consumption by XX % by the year 2020 while increasing the profitability of farming.

Timing: Achieve XX% reduce consumption by 20XX. Achieve the full policy goal by 2020.

Coverage of parties: Colorado Rural Electric Associations, State Agriculture Organizations, Governors Office of Energy Management and Conservation, Colorado Department of Agriculture, Businesses providing energy efficiency and renewable energy equipment.

Other: As needed, identify incentives that encourage the growing and supply of feedstocks, and the utilization of ethanol in transportation markets across the state.

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

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

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

AFW-4. Biodiesel Production

Mitigation Option Description

Provide incentives for the production of biodiesel from oilseed crops, waste vegetable oil, or other sources. Biodiesel use will offset diesel fuel derived from petroleum and will lead to decreased fossil fuel-based CO₂ emissions.

Mitigation Option Design

Goals: Biodiesel fuel will make up 20% of the state diesel fuel demand by 2020.

Timing: Produce enough in-state biodiesel to offset 2% of Colorado's petro-diesel consumption by 2010 and 20% by 2020.

Coverage of parties: Governor's Office of Energy Management and Conservation, Colorado Dept. of Agriculture, Rocky Mountain Farmers Union, Colorado Farm Bureau, Colorado Livestock Association.

Other:

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

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

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

AFW-5. Ethanol Production

Mitigation Option Description

Trees, crops and other plants convert atmospheric carbon to carbohydrate or fiber stocks that can be converted to liquid fuels, such ethanol. The use of these renewable, biological fuels can offset fossil fuel use and reduce associated net carbon dioxide emissions. Production incentives for the conversion of crops, forest sources, animal waste and other sources to ethanol through existing or new technologies can increase the level of ethanol use in future markets. In-state production of ethanol using GHG-superior feedstocks and processes (e.g. cellulosic technologies) offer the highest GHG benefits and complement policies to increase ethanol consumption (e.g. TLU-5).

Mitigation Option Design

Goals: Increase in-state ethanol production using GHG-superior feedstocks and production methods to XX gallons per year above BAU by 2020.

Timing: Add additional ethanol production capacity of XX gallons/yr by 2012 and achieve the full policy goal by 2020.

Coverage of parties: Suppliers of feedstocks, ethanol producers and distributors. Associated agencies would include: xxx...

Other:

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO_{2e}

TBD

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

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

AFW-6. Preserve Lands with Carbon Storage Value

Mitigation Option Description

Reduce the rate at which existing crop/pasture and forested lands are converted to developed uses. The carbon stored in soils and aboveground biomass is typically higher in these lands than in developed land uses. Each year, developed areas also typically sequester less carbon dioxide than forested areas. Policies are needed to protect working farms and forests from unwise and unplanned development. Indirectly, this option also supports important policies in the transportation and land use sector by promoting more efficient development patterns (e.g. TLU-1).

Mitigation Option Design

Goals: *Reduce the rate of conversion of agricultural and forested lands by XX% by 2020.*

Timing: *By 2012, reduce the rate of conversion by XX%; achieve the full goal by 2020.*

Coverage of parties:

Other:

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

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

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

AFW-7. Biomass Feedstocks for Energy Production

Mitigation Option Description

The goals of this option are to increase the use of low value wood material (including logging and mill residues), agricultural residues, and municipal solid waste fiber by appropriate processing centers for energy purposes (electricity, heating or liquid fuels). Offsetting fossil fuel use with biomass for energy, in applications such as distributed generation, combined heat and power and community energy systems will yield additional GHG emissions reduction benefits.

Mitigation Option Design

Goals: Increase production and use of biomass energy feedstocks by XX% by 2020 through sustainable harvesting and recovery practices.

Timing: Achieve an increase in consumption of biomass energy feedstocks of XX% by 2012; achieve the full goal by 2020.

Coverage of parties:

Other:

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO_{2e}

TBD

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

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

AFW-8. Forestry Programs to Enhance GHG Benefits

Mitigation Option Description

Carbon dioxide is captured and stored in trees, soil and other forest biomass. Any forest management activity that promotes forest productivity will increase carbon dioxide sequestration rates and enhance GHG benefits. Retaining forest management where it is being done and expanding the area covered by management plans would stimulate the rate of productivity. Increasing production of high quality, high density wood with subsequent use of these products in durable wood products (building materials, furniture, etc.) serves as a long-term method for storing carbon. Use of biomass waste from forestry programs for energy purposes is covered under AFW-7.

Mitigation Option Design

Goals: Increase productivity of high quality, high density wood in Colorado's forests by XX%.

Timing: Increase productivity by XX% by 2012 and achieve the full goal by 2020.

Coverage of parties:

Other:

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

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

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

AFW-9. Prevent Landfilling of Unprocessed Organic Material

Mitigation Option Description

Landfilling unprocessed organic material (food wastes, agricultural wastes, biosolids, lawn & garden wastes, or other organic materials) produces methane emissions, as these wastes undergo anaerobic decomposition. By processing these materials prior to landfilling or for beneficial reuse, the net GHG emissions can be reduced. Alternatives include composting and anaerobic digestion. Anaerobic digestion can also provide a source of renewable energy (methane) to offset fossil fuel use.

Mitigation Option Design

Goals: Divert XX% unprocessed organic materials to processes that result in net GHG benefits.

Timing: Divert XX% by 2012; achieve the full goal by 2020.

Coverage of parties:

Other:

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO_{2e}

TBD

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

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

AFW-10. Landfill Methane 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

Goals: *Increase the number of uncontrolled municipal solid waste landfills recovering methane as an energy source, such that XX% of the methane 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 2012, implement LFGTE at XX sites not currently using these technologies; by 2020, achieve full implementation of the policy (XX% coverage of generated methane).*

Coverage of parties:

Other:

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

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

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

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