



www.mtclimatechange.us

Catalog of State-Level GHG Reduction Policy Options Agriculture, Forestry, and Waste Management

Prepared by The Center for Climate Strategies (CCS) for the Montana Climate Change Advisory Committee (CCAC) and its Scientific Advisory Panel (SAP) and Technical Work Groups (TWGs) based on actions undertaken or considered by all US states.

Key to Future Rankings of Options in the Table that Follows:

Potential Emission Reductions <u>1/</u>	Potential Cost or Cost Savings <u>1/ 2/</u>
High (H): At least 1 Million Metric Tons (MMT) carbon dioxide equivalent (CO ₂ e) per year by 2020 (~1% of current MT emissions)	High (H): \$50 per Metric Ton CO ₂ e (MTCO ₂ e) or above
Medium (M): From 0.1 to 1 MMT CO ₂ e per year by 2020	Medium (M): \$5-50/MTCO ₂ e
Low (L): Less than 0.1 MMT CO ₂ e per year by 2020, or 1 MMT CO ₂ e by 2050	Low (L): Less than \$5/MTCO ₂ e
Uncertain (U): Not able to estimate at this time	Uncertain (U): Not able to estimate at this time
<p><small>1/ Several measures may overlap in terms of emissions reductions and/or cost impacts. Estimates assume measures would be implemented independently from other measures.</small></p> <p><small>2/ Costs are denoted by a positive number. Cost savings (i.e., “negative costs”) are denoted by a negative number.</small></p>	

Definition of “Priorities for Analysis”:

- **High:** High priority options will be analyzed first.
- **Medium:** Medium priority options will be analyzed next, time and resources permitting.
- **Low:** Low priority options will be analyzed last, time and resources permitting.

Notation of Options: Options will be marked with an asterisk (*) at a later date to indicate options that are at least partially “base case” policies, i.e., that have been considered or undertaken at some level in Montana.

Potential State Actions - Agriculture, Forestry, & Waste Management (AFW)

Option No.	GHG Reduction Policy Option	Priority for Analysis	Potential GHG Emissions Reduction	Potential Cost or Cost Savings	Additional Impacts, Feasibility Considerations	Notes
AFW-1	AGRICULTURE – PRODUCTION OF FUELS AND ELECTRICITY					
1.1	Manure Digesters/Other Waste Energy Utilization					
1.2	Biodiesel Production (incentives for feedstocks and production plants)					
1.3	Biomass Feedstocks for Electricity or Steam Production					
1.4	Ethanol Production					
AFW-2	AGRICULTURE – FERTILIZER AND MANURE MANAGEMENT					
2.1	Nutrient Management (improve efficiency of fertilizer use)					
2.2	Manure Management (improve application methods)					
2.3	Manure Composting					
2.4	Change Feedstocks (optimize nitrogen for N ₂ O reduction)					
2.5	Reduce Non-Farm (Residential and Commercial) Fertilizer Use					

Option No.	GHG Reduction Policy Option	Priority for Analysis	Potential GHG Emissions Reduction	Potential Cost or Cost Savings	Additional Impacts, Feasibility Considerations	Notes
AFW-3	AGRICULTURE – SOIL CARBON MANAGEMENT					
3.1	Conservation Tillage/No-Till (carbon sequestration and reduced energy use)					
3.2	Reduce Summer Fallow (increase soil C content, reduce N ₂ O emissions)					
3.3	Increase Winter Cover Crops (increase soil C and/or N content)					
3.4	Improve Water and Nutrient Use (to minimize soil C loss)					
3.5	Rotational Grazing/Improve Grazing Crops and/or Management					
AFW-4	AGRICULTURE – LAND USE CHANGE					
4.1	Convert Land to Grassland or Forest					
4.2	Preserve Open Space/Agricultural Land					
4.3	Promote “No Net Loss” of Agricultural Land					
AFW-5	AGRICULTURE – FARMING PRACTICES					
5.1	Convert Diesel Farm Equipment to LNG/CNG or Hybrid Technology					

Option No.	GHG Reduction Policy Option	Priority for Analysis	Potential GHG Emissions Reduction	Potential Cost or Cost Savings	Additional Impacts, Feasibility Considerations	Notes
5.2	Organic Farming					
5.3	Programs to Support Local Farming/Buy Local					
AFW-6	FORESTRY – BIOMASS PROTECTION AND MANAGEMENT					
6.1	Forest Protection – Reduced Clearing And Conversion to Nonforest Cover					
6.2	Increase Maintenance of Urban and Residential Trees					
6.3	Afforestation and/or Restoration of Nonforested Lands					
6.4	Reforestation/Restoration of Managed Stands					
6.5	Increased Stocking of Poorly Stocked Lands					
6.6	Age Extension of Managed Stands					
6.7	Thinning and Density Management of Managed Stands					
6.8	Fertilization and Waste Recycling					

Option No.	GHG Reduction Policy Option	Priority for Analysis	Potential GHG Emissions Reduction	Potential Cost or Cost Savings	Additional Impacts, Feasibility Considerations	Notes
6.9	Expand Short Rotation Woody Crops (for fiber and energy)					
6.10	Expanded Use of Genetically Preferred Species					
6.11	Modified Biomass Removal Practices (reduced decay and energy use)					
6.12	Fire Management and Risk Reduction Programs					
6.13	Ecosystem Health Risk Reduction Programs (pest/disease, invasive species)					
6.14	Drought Management Programs (tree selection, placement, protection)					
6.15	Flood and Riparian Management Programs (tree selection, placement, protection)					
6.16	Watershed Management Programs (stand retention, enhancement and management)					

Option No.	GHG Reduction Policy Option	Priority for Analysis	Potential GHG Emissions Reduction	Potential Cost or Cost Savings	Additional Impacts, Feasibility Considerations	Notes
6.17	Habitat Management Programs (stand retention, enhancement and management)					
AFW-7	FORESTRY - WOOD PRODUCTS AND WASTE					
7.1	Improved Mill Waste Recovery					
7.2	Improved Logging Residue Recovery					
7.3	Expanded Use of Wood Products for Building Materials					
7.4	Expanded Use of State and Locally-Grown Wood Products					
AFW-8	FORESTRY – ENERGY PRODUCTION					
8.1	Expanded Use of Forest Biomass Feedstocks for Electricity (fuel switching)					
8.2	Expanded Use of Forest Biomass Feedstocks for Residential, Commercial/Institutional, or Industrial Heating					
8.3	Improved Efficiency of Wood Burning Stoves and Direct Heat					

Option No.	GHG Reduction Policy Option	Priority for Analysis	Potential GHG Emissions Reduction	Potential Cost or Cost Savings	Additional Impacts, Feasibility Considerations	Notes
8.4	Improved Energy Capture from Wood Waste Combustion					
8.5	Expanded Landfill Methane Recapture (wood products waste)					
8.6	Improved Commercialization of Biomass Gasification and Combined Cycle					
AFW-9	WASTE MANAGEMENT – WASTE MANAGEMENT STRATEGIES					
9.1	Advanced Recycling and Composting					
9.2	Advanced Municipal Solid Waste Management Practices (e.g., bioreactors)					
9.3	Source Reduction Strategies					
9.4	Resource Management Contracting					
9.5	Manure Digesters					
9.6	Waste Coal Recapture					
AFW-10	WASTE MANAGEMENT – LANDFILL GAS STRATEGIES					
10.1	Flare Landfill Methane at non-NSPS (smaller) sites					
10.2	Methane and Biogas Energy Programs					

Option No.	GHG Reduction Policy Option	Priority for Analysis	Potential GHG Emissions Reduction	Potential Cost or Cost Savings	Additional Impacts, Feasibility Considerations	Notes
10.3	Convert Landfill Methane to Electric Power, Space Heat, or LNG					
AFW-11	WASTE MANAGEMENT – WASTEWATER ACTIVITIES					
11.1	Energy Efficiency Improvements					
11.2	Lower Waste Processing Needs (lower water consumption, waste production)					
11.3	Install Digesters and Turbines					
11.4	Install Fuel Cells					