

Catalog of State Actions Agriculture, Forestry, and Waste Management Working Group

A catalog of state-level, GHG-reducing actions and policy options based on actions undertaken or considered by state, local and private actors.

Key to Future Rankings of Options in the Tables that Follow:

Potential GHG Emission Reductions <u>1/</u>	Potential Cost or Cost Savings <u>1/ 2/</u>
High (H): At least 1.0 million metric tons (MMt) carbon dioxide equivalent (CO ₂ e) per year by 2020	High (H): \$50 per metric ton CO ₂ e (tCO ₂ e) or above
Medium (M): From 0.1 to 1.0 MMtCO ₂ e per year by 2020	Medium (M): \$5-50/tCO ₂ e
Low (L): Less than 0.1 MMtCO ₂ e per year by 2020, or 1 MMtCO ₂ e by 2050	Low (L): Less than \$5/tCO ₂ e
Uncertain (U): Not able to estimate at this time	Negative (Neg): Net cost savings
	Uncertain (U): Not able to estimate at this time
<p><u>1/</u> Several measures may overlap in terms of emissions reductions and/or cost impacts. Estimates assume measures would be implemented independently from other measures.</p> <p><u>2/</u> Costs are denoted by a positive number. Cost savings (i.e., “negative costs”) are denoted by a negative number.</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 marked in bold an asterisk (*)** indicate some of the related state actions that are approved or underway, as described further in the companion options description document. TWG members are encouraged to provide information on other relevant actions.

Agriculture, Forestry, and Waste Management (AFW)

Option No.	GHG Reduction Policy Option	Potential GHG Emissions Reduction	Cost per Ton	Other Considerations: Jobs, Fuel Imports, Externalities, Feasibility	Priority for Analysis	Notes / Related Actions in MN
AFW-1 AGRICULTURE – PRODUCTION OF FUELS AND ELECTRICITY						
1.1	Expanded Use of Biomass Feedstocks for Electricity, Heat or Steam Production*	H	L-M	Includes purpose-grown crops (e.g. switchgrass) as well as traditional starch and oil production crops.		<ul style="list-style-type: none"> • Biomass for Electricity
1.2	In-State Liquid Biofuels Production	H	L-M	Includes purpose-grown crops (e.g. switchgrass) as well as traditional starch and oil production crops.		<ul style="list-style-type: none"> • Renewable Fuels Initiative • Ethanol • E85 • Production Incentives • Biodiesel
1.3	Manure Digesters/Other Waste Energy Utilization*	M	M-H			<ul style="list-style-type: none"> • Renewable Energy Production Incentive • Community-based renewable energy development • Biomass for electricity
AFW-2 AGRICULTURE – LIVESTOCK						
2.1.1	Manure Management: Manure Utilization	L-M	L			Some overlap with Option 3.2, where more efficient manure utilization could displace the use of commercial fertilizers.
2.1.2	Manure Management: Manure/Methane Capture	M	M-H			Overlap with Option 1.3 (kept here to capture the packaging with 2.1.a)
2.2	Changes in Animal Feed	L-M	??			
2.3	Rotational Grazing (Improve	L	??			

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	Grazing Crops and/or Management)					
2.4	Utilize Biofilters to Control CAFO Emissions	M-H	??	- Potential for control of both enteric fermentation & manure CH ₄ ?		CAFO – confined animal feeding operation. Encourage confinement where this leads to additional opportunities for CH ₄ capture & control.
2.5	Increase Pasturing & Lower Densities	L-M	??			Decrease CH ₄ generation potential for manure deposited in feedlots, pastures, etc.
AFW-3	AGRICULTURE – CROP PRODUCTION					
3.1	Soil Carbon Management	H	L			<i>Blue Earth River Basin Initiative ran a project called the Third Crop Initiative. This initiative aims to replace annual crops with perennial crops.</i>
3.2	Nutrient Management	L-M	L			Some overlap with 2.1.a in that efficient use of manure could displace some commercial N-fertilizer use.
3.3	Technology Improvements to Increase Efficiency	L-M	??			e.g. Auto-Steer guidance systems, auto-swath technology, variable rate fertilization/liming.. Also relates to Option 5.1.
3.4	Water Management	??	??			Emissions reductions and costs dependent on extent of irrigation pumping that occurs in the State.
3.5	Drainage Management	??	??			
AFW-4	AGRICULTURE – LAND USE CHANGE					

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4.1	Land Use Management that Promotes Perennial Herbaceous Cover*	H	L			<ul style="list-style-type: none"> • Conservation Land Development
4.2	Preserve Open Space/ Agricultural Land*	L	H	- difficult to quantify additional indirect benefits from more efficient development.		<ul style="list-style-type: none"> • Conservation Land Development • Method of implementation drives cost (land use policy could be cheaper than conservation easements)
AFW-5 AGRICULTURE – FARMING PRACTICES						
5.1	Reductions in On-Farm Energy Use*	M	Neg-L			<ul style="list-style-type: none"> • Renewable Fuels Initiative • Potential overlap with 3.3.
5.2	Promotion of Farming Practices that Achieve GHG Benefits	??	??			<ul style="list-style-type: none"> • e.g. some organic farming practices can reduce GHG via higher soil organic carbon, lower fertilizer/pesticide use.
5.3	Programs to Support Local Farming/Buy Local	L-M	??	- difficult to fully account for benefits and costs.		
AFW-6 FORESTRY – PRODUCTION OF FUELS AND ELECTRICITY IN FORESTRY						
6.1	Expanded Use of Forest Biomass Feedstocks for Electricity, Heat and Steam Production*	M-H	L-H	- costs vary dramatically depending on implementation mechanisms.		<ul style="list-style-type: none"> • Biomass to Energy <i>Laurentian Energy Authority Biomass Energy Project. This project has produced a partnership between public utilities in the Cities of Virginia and Hibbing. Public utilities in these cities have converted formerly coal-fired power plants to power plants that re now 75% fueled by woody biomass.</i>

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						<i>Minnesota currently does not allow roundwood timber to be used for energy generation, as this wood can be used to make long-lived wood products with long term sequestration potential.</i>
6.2	In-State Liquid Biofuels Production*	H	L-M			<ul style="list-style-type: none"> • Biodiesel • Renewable Fuels Initiative • Ethanol
6.3	Improved Energy Capture from Wood Waste Combustion*	L-M	??			<ul style="list-style-type: none"> • Waste to Energy
6.4	Improved Commercialization of Biomass Gasification and Combined Cycle*	L-H	??	- reductions dependent on assumed technology penetration - costs dependent on structure of incentives program		<ul style="list-style-type: none"> • Renewable Energy Production Incentive
AFW-7	FORESTRY – BIOMASS PROTECTION AND MANAGEMENT					
7.1	Forest Protection – Reduced Clearing And Conversion to Nonforest Cover*	H	M			<ul style="list-style-type: none"> • Conservation land development <i>The Minnesota Forest Legacy Partnership (MFLP) is pursuing 127,000 acres of forest conservation easements in Koochiching and Itasca Counties.</i>
7.2	Urban Forestry*	L-M	M-H			<ul style="list-style-type: none"> • Terrestrial Carbon Sequestration Initiative
7.3	Afforestation and/or Restoration of Nonforested Lands*	H	M			<ul style="list-style-type: none"> • Terrestrial Carbon Sequestration Initiative <i>The Board of Soil and Water Resources (BSWR) has been directed by the 2007 MN</i>

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						<i>legislature to administer \$500k in grants to conduct site level ecological research and assessments, a clean energy program, and technical teams for native seed harvesting and working lands initiative.</i>
7.4	Forest Management for Carbon Sequestration*	H	??	- costs dependent on number and type of programs implemented.		<ul style="list-style-type: none"> • Terrestrial Carbon Sequestration Initiative • Refers to a broad range of forest management options that result in carbon benefits (including those specified under 7.5 and 7.6).
7.5	Mitigation of Forest Carbon Sequestration Loss and Emissions Due to Wildfire	L-M	??	- additional benefits to wildlife and biodiversity.		
7.6	Mitigation of Forest Loss Due to Insects/Disease	??	??			
AFW-8	FORESTRY – WOOD PRODUCTS AND WASTE					
8.1	Improved Mill Waste Recovery; Utilization of Mill Residues & Emissions	L	L	- TWG members felt that current practice uses 100% of residues.		CO ₂ emissions from pulp mills could be captured to produce carbonates.
8.2	Improved Logging Residue Recovery	L	??	- TWG members felt that current practice uses 100% of residues.		
8.3	Expanded Use of Wood Products for Building Materials	M	??	- difficult to quantify full benefits across all building sectors; also difficult to quantify costs of programs to promote use of wood products		

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AFW-9 WASTE MANAGEMENT – WASTE MANAGEMENT STRATEGIES						
9.1	Advanced Recycling*	H	L-M			<ul style="list-style-type: none"> Reinvigorate Recycling Campaign
9.2	Promotion of Bioreactor Technology (Advanced Municipal Solid Waste Management Practices)*	H	L			<ul style="list-style-type: none"> Technical Assistance Program
9.3	Source Reduction Strategies	H	??	- cost information has been difficult to obtain.		
9.4	Resource Management Contracting	L	??			Commonly-employed in MN. Additional opportunities beyond BAU?
9.5	Incentives for Municipalities to Manage Waste Collection	L-M	??			
9.6	Enhanced Management of Organic Waste	M-H	L-M			
9.7	Promotion of New or Existing Technologies for Waste Energy Conversion	L-H	??	- benefits dependent on penetration of new/existing technologies; - costs dependent on structure of incentives program.		New technologies could include biomass gasification and pyrolysis for producing biofuels, biochar and other products.
AFW-10 WASTE MANAGEMENT – LANDFILL GAS STRATEGIES						
10.1	Flare Landfill Methane at non-NSPS (smaller) Sites	L	H	- technical feasibility of collecting and controlling methane at some sites is questionable.		
10.2	Methane and Biogas Energy Programs*	??	M-H	- waste streams other than MSW where this can be applied in MN?		<ul style="list-style-type: none"> Renewable Energy Production Incentive
10.3	Landfill Methane Energy Programs	H	Neg-L			<ul style="list-style-type: none"> - this option refers specifically to landfill methane.
AFW-11 WASTE MANAGEMENT – WASTEWATER ACTIVITIES						

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11.1	Energy Efficiency Improvements*	M-H	Neg-L			<i>Xcel operates a process efficiency program; a sub-program within the mandated conservation improvement program.</i>
11.2	Lower Waste Processing Needs (lower water consumption, waste production)	L	??			
11.3	Install Digesters and Turbines or Engines*	L-M	L			<ul style="list-style-type: none"> Renewable Energy Production Incentive <i>The MCES has recently installed 2 2-MW turbine generators at its Empire WWTP. The council is also considering the installation of digesters and methane recovery systems at Blue Lake WWTP, and potentially more WWTPs.</i>
11.4	Restoration of Soil Organic Carbon from Application of WWTP Biosolids	L-M	??			
11.5	Heat Recovery	??	??			<ul style="list-style-type: none"> Recover heat from plant influent or effluent.
11.6	Algae and Bio-Oils	M-H	??			
AFW-12	AGRICULTURE/FORESTRY – CONSERVATION OF NUTRIENT-RICH LANDS					
12.1	Conservation of Peatlands	??	??			
12.2	Conservation and/or Expansion of Wetlands	??	??	- issue of CH ₄ emissions impact on annual carbon sequestration benefit.		
AFW-13	TERRESTRIAL CARBON MARKETS					
13.1	Facilitate the Development of	??	??			

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	Terrestrial Sequestration Offsets Market(s)					