



Catalog of State Actions

Agriculture, Forestry, and Waste Management Technical Work 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 Following Tables

Potential GHG Emission Reductions*	Potential Cost or Cost Savings* [†]
High (H): At least 1.0 million metric tons of carbon dioxide equivalents (MMtCO ₂ e) per year by 2025	High (H): \$50 per metric ton of carbon dioxide equivalent (tCO ₂ e) or above
Medium (M): From 0.1 to 1.0 MMtCO ₂ e per year by 2025	Medium (M): \$5–\$50/tCO ₂ e
Low (L): Less than 0.1 MMtCO ₂ e per year by 2025, or 1.0 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

* Several measures may overlap in terms of emission reductions and/or cost impacts. Estimates assume measures would be implemented independently of other measures.

[†] Costs are denoted by a positive number. Cost savings (i.e., “negative costs”) are denoted by a negative number.

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 the Following Options:

Option titles followed by an asterisk (*) indicate some of the related state actions that are approved or underway, as described further in the companion brief options description document. Technical Work Group members are encouraged to provide information on other relevant actions.

Option No.	GHG Reduction Policy Option	Potential GHG Emission Reductions	Cost per Ton	Other Considerations: Jobs, Fuel Imports, Externalities, Feasibility	Priority for Analysis	Notes/Related Actions in Kansas
AFW-1	AGRICULTURE—PRODUCTION OF ENERGY AND MATERIALS					
1.1	Expanded Utilization of Biomass Feedstocks for Electricity, Heat, or Steam Production	M	M	Combine w/ 6.1		<ul style="list-style-type: none"> • Westar released a request for proposals (RFP) for 500 megawatts (MW) of renewable energy. • Executive Order 08-04: Kansas Energy Council (KEC) instructed to collect and compile information on available and currently utilized renewable energy resources in Kansas. • Potential Project: Sunflower Integrated Bioenergy Center, producing electricity using methane from anaerobic digestion of manure, as well as by-products of biodiesel and ethanol production.

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1.2	In-State Liquid Biofuels Production	M	M	Gasoline displacement. Combine w/ 6.2. Jobs and economic growth, reduction of petroleum imports.		<ul style="list-style-type: none"> • Bioenergy Research Grant Program recommended to spur development of cost-efficient renewable fuels. Goal for Kansas: produce 20% of nation's alternative fuel needs. • Cellulosic ethanol plant planned for Hugoton, KS (Stevens County). Projected capacity of 14 MGY. • Potential Project: Sunflower Integrated Bioenergy Center, producing ethanol and biodiesel in a closed-loop process that includes an algae reactor and reuses many of the by-products from the fuel-making process. • Cellulosic research facility in Hugoton. • PrairieFire BioFuels Coop established an office in Healy, KS. PrairieFire's mission is to "transform renewable biomass or agri fiber into carbon neutral pellet fuel for residential or industrial use."

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1.3	Manure Digesters/Other Waste Energy Utilization	M	M-H	Combine w/ 2.1 Manure Management and Utilization.		<ul style="list-style-type: none"> Potential Project: Sunflower Integrated Bioenergy Center, producing electricity methane from anaerobic digestion of manure, as well as by-products of biodiesel and ethanol production.
1.4	Integrated Bioenergy Production	M	H			<ul style="list-style-type: none"> Potential Project: Sunflower Integrated Bioenergy Center, producing electricity methane from anaerobic digestion of manure, as well as by-products of biodiesel and ethanol production.
1.5	Improving Energy Capture From Corn and Biomass Heat	L	L-M	Combine w/ 1.1 Expanded Utilization of Biomass Feedstocks for Electricity, Heat, or Steam Production and/or 1.2 In-State Liquid Biofuels Production.		
1.6	Expand Production/Use of Bio-Based Materials and Chemicals	M	L			

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1.7	Improved Commercialization of Biomass Conversion Technologies	M	M	Combine w/ 1.1 Expanded Utilization of Biomass Feedstocks for Electricity, Heat, or Steam Production and/or 1.2 In-State Liquid Biofuels Production.		
1.8	Bioenergy Research	L–M	L			<ul style="list-style-type: none"> The Biosciences Authority is a potential source of funding.
AFW-2	AGRICULTURE—LIVESTOCK					
2.1	Manure Management and Utilization	L–M	L	Combine w/ 1.3 Manure Digesters/Other Waste Energy Utilization.		<ul style="list-style-type: none"> Kansas State University (KSU) field trial for reduction of phosphate in animal waste lagoons.
2.2	Changes in Animal Feed	L	M	Potential lost efficiencies and increased ingredient costs could be substantial to livestock feeders, but this is unknown until that research is done.		
2.3	Technology Improvements To Increase Water Conservation	L	L			

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2.4	Technology Improvements To Increase Efficiency (Livestock)	L–M	L	Need lower quantities of feed and less land mass for crop production, while increasing livestock production.		
AFW-3	AGRICULTURE—CROP PRODUCTION					
3.1	Soil Carbon Management	M–H	Neg–L	Combine w/ other catalog items that address enhanced agricultural sequestration: 3.3, 3.7, 4.1, 4.2, 5.2, 7.4. Lower water needs for similar yields and provision of many environmental benefits.		<ul style="list-style-type: none"> • KSU Soil Carbon Center leads research on soil carbon sequestration. Many Kansas farmers are involved in no-till practices. • No Till on the Plains organization. • Chicago Climate Exchange has an offset program that includes soil carbon. • 25 active Watershed Restoration and Protection Strategy (WRAPS) projects in Kansas. • 20,000 acres in the Kansas Upper Arkansas River Conservation Reserve Enhancement Program will transition irrigated land into conservation planting for a minimum of 14–15 years.

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3.2	Nutrient Management	M-H	U	May have excellent potential over the long term by reducing fertilizer and fuels.		
3.3	Technology Improvements To Increase Efficiency (Crop Production)	M-H	Neg-L	Combine w/3.1 Soil Carbon Management. Higher production on less land mass with lower input requirements.		

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3.4	Water Management	M	U			<ul style="list-style-type: none"> • KSU Research and Extension Mobile Irrigation Lab provides education and technical assistance to KS agricultural producers. • KanSched assists producers in determining the best time for irrigation. • The City of Wichita and State Conservation Commission have collaborated on cost share to implement BMPs. • Water Transition Assistance Program purchases and retires water rights in overappropriated areas. • USDA EQIP has enrolled acres in “quick response areas.”
3.5	Drainage Management	L	L			
3.6	Biotechnology Applications for GHG Mitigation	U	U	Less pesticide, fertilizer, water, and other inputs, while increasing yields.		

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3.7	Perennial Crop Production	L–M	Neg	Combine w/ 3.1. May reduce production per unit of land.		
AFW-4	AGRICULTURE—LAND-USE CHANGE					
4.1	Land-Use Management That Promotes Permanent Cover—State Action	M–H	Neg–L	Combine w/ 3.1, 4.2, 5.2. No till lowers fuel quantity per unit of land. Food cost could increase.		<ul style="list-style-type: none"> This action refers to actions that could be implemented at the state level. No Till on the Plains organization. 20,000 acres in the Kansas Upper Arkansas River Conservation Reserve Enhancement Program will transition irrigated land into conservation planting for a minimum of 14–15 years. “Bioenergy and Water” is a priority issue in the 2008 State Water Plan.
4.2	Land-Use Management That Promotes Permanent Cover—State Input on Federal Policy	M	Neg–L	Combine w/ 3.1, 4.1. Food cost could increase.		<ul style="list-style-type: none"> This action refers to influencing federal policy on land-use management.

Option No.	GHG Reduction Policy Option	Potential GHG Emission Reductions	Cost per Ton	Other Considerations: Jobs, Fuel Imports, Externalities, Feasibility	Priority for Analysis	Notes/Related Actions in Kansas
4.3	Preserve Open Space/Agricultural Land	L–M	L	Combine w/ 7.1 Rangeland & Forest Protection—Reduced Clearing and Conversion to Non-Forest Cover.		<ul style="list-style-type: none"> • Kansas mayors agree to adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable, urban communities. • State funding is a limiting factor; brownfields development can lower pressure to convert other open space/agricultural lands. • Kansas Land Trust.
4.4	Prioritize Environmental Remediation Actions for GHG Benefits	L	M			<ul style="list-style-type: none"> • A relevant example is the revegetation of disturbed lands to improve carbon sequestration.
AFW-5	AGRICULTURE—FARMING PRACTICES					
5.1	Increase On-Farm Energy Production and Efficiency	L–M	L			<ul style="list-style-type: none"> • 20,000 acres in the Kansas Upper Arkansas River Conservation Reserve Enhancement Program will transition irrigated land into conservation planting for a minimum of 14–15 years.
5.2	Promotion of Farming Practices That Achieve GHG Benefits	L–M	Neg–L	Combine w/ 3.1, 4.1.		

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5.3	Programs To Support Local Farming/Buy Local	L	L			
5.4	Promotion of Urban Agriculture, Community Gardens, Green Roofs, and Locally Sourced School Foods	L	L			
AFW-6	RANGELAND AND FORESTRY—PRODUCTION OF ENERGY AND MATERIALS					
6.1	Expanded Use of Rangeland and Forest Biomass Feedstocks for Electricity, Heat, and Steam Production	L–M	L–M	Combine w/ 1.1.		<ul style="list-style-type: none"> • Westar released an RFP for 500 MW of renewable energy. • Executive Order 08-04 instructed KEC to collect and compile information on available and currently utilized renewable energy resources in Kansas.

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6.2	In-State Liquid Biofuels Production	M	M	Gasoline displacement; Combine w/ 1.2. Displacement of fossil fuel lower dependence on foreign oil.		<ul style="list-style-type: none"> Bioenergy Research Grant Program recommended to spur development of cost-efficient renewable fuels. The goal for Kansas is to produce 20% of the nation's alternative fuel needs. PrairieFire BioFuels Coop established an office in Healy, KS. PrairieFire's mission is to "transform renewable biomass or agri fiber into carbon neutral pellet fuel for residential or industrial use."
6.3	Improved Energy Capture From Wood Waste Combustion	L	U			
6.4	Improved Commercialization of Biomass Conversion Technologies	M	M	Needed for 6.1 and 6.2.		
6.5	Expanded Use of New, Reused, and Recycled Wood Products for Building Materials	L	L	Not appropriate for Kansas.		
AFW-7	RANGELAND AND FORESTRY—BIOMASS PROTECTION AND MANAGEMENT					

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7.1	Rangeland and Forest Protection—Reduced Clearing and Conversion to Non-Forest Cover	M	Neg–L	Combine w/ 4.3 Preserve Open Space/Agricultural Land Not applicable for KS.		<ul style="list-style-type: none"> 2008 update of the Kansas Water Plan is developing a policy to promote better protection of forest riparian areas through enhanced use of conservation easements.
7.2	Urban Forestry	L	L	Not applicable for KS.		<ul style="list-style-type: none"> Kansas mayors agree to maintain healthy urban forests, promote tree planting, and increase shading. Kansas has 113 cities and towns recognized as Tree City USA communities.
7.3	Afforestation and/or Restoration of Non-Forested Lands	L	M	Not applicable for KS.		
7.4	Rangeland and Forest Management for Carbon Sequestration	L–M	Neg–L	Combine w/ 3.1 Soil Carbon Management. Not applicable for KS.		
7.5	Mitigation of Forest and Rangeland Carbon Sequestration Loss and Emissions Due to Wildfire	L–M	U	Tall-grass prairie burning may increase net carbon sequestration levels. Not applicable for KS. Encourage rangeland burning.		

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7.6	Mitigation of Forest Loss Due to Insects/Disease	L	H	Not applicable for KS.		<ul style="list-style-type: none"> KDA Plant Protection and Quarantine coordinates with USDA, Kansas Forest Services, and others to identify plant pests that may impact forests in Kansas.
AFW-8	RANGELANDS & FORESTRY—BIOMASS INDUSTRY					
8.1	Improved Mill Waste Recovery—Utilization of Sawmill Residues and Emissions	L	U	Low potential for KS.		<ul style="list-style-type: none"> Limited potential in KS.
8.2	Improved Logging Residue Recovery	L	U	Low potential for KS.		<ul style="list-style-type: none"> Limited potential in KS.
8.3	Silviculture Improvements	L	U	Low potential for KS.		
AFW-9	WASTE MANAGEMENT—WASTE MANAGEMENT STRATEGIES					
9.1	Expanded Use of MSW Waste Biomass Feedstocks for Electricity, Heat, and Steam Production*	L-M	M-H	Low potential for KS.		<ul style="list-style-type: none"> Westar released an RFP for 500 MW of renewable energy. Executive order 08-04 instructed KEC to collect and compile information on available and currently utilized renewable energy resources in Kansas.

Option No.	GHG Reduction Policy Option	Potential GHG Emission Reductions	Cost per Ton	Other Considerations: Jobs, Fuel Imports, Externalities, Feasibility	Priority for Analysis	Notes/Related Actions in Kansas
9.2	In-State Liquid Biofuels Production*	L–M	H	Enhance economic growth.		<ul style="list-style-type: none"> Bioenergy Research Grant Program recommended to spur development of cost-efficient renewable fuels. Goal for Kansas to produce 20% of the nation's alternative fuel needs. PrairieFire BioFuels Coop established an office in Healy, KS. PrairieFire's mission is to "transform renewable biomass or agri fiber into carbon neutral pellet fuel for residential or industrial use."
9.3	Advanced Recycling and Composting	M–H	L			<ul style="list-style-type: none"> In 2008, Governor Sebelius issued an Executive directive that included the implementation of a recycling program in every state office building by 2007. State agencies implementing a paper reduction effort.
9.4	Promotion of Bioreactor Technology (Advanced Municipal Solid Waste Management Practices)	L–M	H			

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9.5	Source Reduction Strategies	L	L			
9.6	Resource Management Contracting	L	U			
9.7	Enhanced Management of Organic Waste	L	L			
9.8	Improved Commercialization of Biomass Conversion Technologies	L	L			
AFW-10	WASTE MANAGEMENT—LANDFILL GAS STRATEGIES					
10.1	Flare Landfill Methane at Non-NSPS (Smaller) Sites	L	M			
10.2	Methane and Biogas Energy Programs*	L-M	M	Consider combining 10.1, 10.2, 10.3 to encourage utilization of methane.		<ul style="list-style-type: none"> Kansas mayors agree to increase the use of clean renewable energy, such as landfill methane and waste-to-energy technology.
10.3	Landfill Methane Energy Programs	M	M			
AFW-11	WASTE MANAGEMENT—WASTEWATER MANAGEMENT ACTIVITIES					
11.1	Wastewater Treatment Plant Biosolids for Energy Production*	L	U			<ul style="list-style-type: none"> Kansas mayors agree to explore opportunities to increase pump efficiency and recover wastewater treatment methane for energy production.

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11.2	Energy Efficiency Improvements*	L	U			<ul style="list-style-type: none"> KS FCIP is responsible for administering a grant program aimed at reducing energy use.
11.3	Lower Waste Processing Needs (Lower Water Consumption, Waste Production)	L	M			
11.4	Install Digesters and Turbines or Engines	L	H			
11.5	Algae and Bio-Oils	L	H			
11.6	Use of Wetlands for Energy Efficiency and Carbon Sequestration	L	L-H	Wetlands naturally release methane. Therefore, the offset of other GHG sequestration may not compensate for the natural releases of methane.		

BMP = best management practice; EQIP = Environmental Quality Incentives Program; FCIP = Facility Conservation Improvement Program; GHG = greenhouse gas; KDA = Kansas Department of Agriculture; KEC = Kansas Energy Council; KS = Kansas; KSU = Kansas State University; MGY = million gallons per year; MSW = municipal solid waste; MW = megawatt; NSPS = new source performance standard; RFP = request for proposals; USDA = United States Department of Agriculture.