Brief Description of Catalog Items
Agriculture, Forestry, and Waste Management
Technical Work Group

(Note: This listing is incomplete and will be fleshed out during the Technical Work Group (TWG) process. TWG members are encouraged to provide input to the TWG facilitators on existing policies and programs, where relevant. Recently enacted policies and programs in Kansas are listed where relevant in the policy options catalog notes. Additional details will be added to this document under each of the option descriptions, as they are provided.)

AFW-1. AGRICULTURE—PRODUCTION OF ENERGY AND MATERIALS

1.1 Expanded Utilization of Biomass Feedstocks for Electricity, Heat, or Steam Production

Increase the amount of biomass available for generating electricity and displacing the use of fossil energy sources. Local electricity or steam production yields the greatest net energy payoff. Note: This is related to AFW-6.1 (forest biomass) and AFW-9.1 (waste biomass).

Recent actions in Kansas: The state's largest utility, Topeka-based Westar, announced on February 26, 2007, a request for proposals (RFP) for 500 megawatts (MW) of renewable energy. While this target may be largely comprised of wind energy, the RFP is not specific to wind and may include biomass resources.

With Executive Order 08-04, the Governor Sebelius instructed the Kansas Energy Council to "collect and compile information pertaining to energy resources, including wind and biomass, in the state, as well as the availability, production and use of energy in the state."

The Sunflower Integrated Bioenergy Center, originally planned to break ground in 2007, is a joint venture between the Sunflower Electric Power Corporation and the National Institute for Strategic Technology Acquisition and Commercialization. This project is expected to include a coal-fired power plant, an anaerobic digester, an algae reactor, a biodiesel plant, an ethanol plant, and a dairy farm. The intention of the Sunflower Integrated Bioenergy Center is to concentrate many renewable energy facilities in order to facilitate the reuse of by-products, reduce transportation costs, and improve cost-effectiveness. This facility will produce various energy commodities, including methane, electricity, ethanol, biodiesel, and electricity. More information may be found at: http://www.sunflower.net/pub/BioEnergyNewsletter070710.pdf.

1.2 In-State Liquid Biofuels Production

Increase production of ethanol and/or biodiesel fuel from agriculture feedstocks and/or municipal solid and other waste (raw materials) to displace the use of fossil fuel. Promote the development of cellulosic ethanol technologies and ethanol production systems that use renewable fuels to improve the embedded energy content of ethanol. Increased production and consumption in

Kansas gives the highest benefits. Note: This is related to AFW-6.2 (forestry biofuels) and AFW-9.2 (waste biofuels).

Recent actions in Kansas: On January 14, 2008, in her State of the State address, the Governor recommended the creation of a Bioenergy Research Grant Program to spur development of innovative technologies producing the most cost-efficient renewable fuels. She also charged the Kansas Bioscience Authority with developing an aggressive plan for bioenergy technology and production, aimed at producing 20% of the nation's alternative fuel needs.

In 2007, Abengoa Bioenergy, a Spanish energy company, announced that Hugoton, Kansas (Stevens County) would be the site of the nation's first cellulosic ethanol plant. As of August 2008, an air construction permit is pending approval from the Kansas Department of Health and Environment for this facility. Projected permitted capacity of cellulosic ethanol production from this facility is 14 million gallons per year.

The planned Sunflower Integrated Bioenergy Center described under 1.1.

PrairieFire BioFuels (PFBF) Coop established an office in Healy, Kansas. PFBF's mission is to "transform renewable biomass or agri fiber into carbon neutral pellet fuel for residential or industrial use."

1.3 Manure Digesters/Other Waste Energy Utilization

Reduce the amount of methane emissions from livestock manure by installing manure digesters on livestock operations. Energy from the manure digesters is used to create heat or power, which offsets fossil fuel–based energy production and the associated greenhouse gas (GHG) emissions. May consider new technologies as well, such as plasma arc technology. The joint U.S. Department of Agriculture (USDA)/U.S. Environmental Protection Agency AgSTAR program maintains extensive information on manure management technologies, including anaerobic digestion. More information may be found at: http://www.epa.gov/agstar/.

Recent actions in Kansas: The planned Sunflower Integrated Bioenergy Center described under 1.1.

1.4 Integrated Bioenergy Production

Integrate bioenergy feedstocks and biofuel production processes to serve multiple GHG-beneficial objectives. For example, manure methane energy derived from confined animal feeding operations (CAFOs) can be used as an energy source to fuel a starch-based ethanol production (lowering the embedded GHGs of the ethanol); dried distillers grain from the ethanol production process can be used as feed for the livestock (thereby reducing transport-related GHG emissions for feed). Other integrated bioenergy production facilities are conceivable, where multiple agricultural or energy production systems are linked to provide large net GHG reductions.

Recent actions in Kansas: The planned Sunflower Integrated Bioenergy Center described under 1.1, above, is an example.

1.5 Improving Energy Capture From Corn and Biomass Heat

Reduce emissions and increase efficiency from heat sources, such as corn and other bio feedstocks. Continue to advance the biomass heating industry. Note: May overlap with the Residential, Commercial, and Industrial TWG policy options related to fuel sources.

1.6 Expand Production/Use of Bio-Based Materials and Chemicals

Increase the amount of renewable products and chemicals produced and used, including building materials that reduce GHG emissions over conventional petroleum-based products.

1.7 Improved Commercialization of Biomass Conversion Technologies

Improve the rate of technology development and market deployment of biomass conversion technologies, including biomass gasification combined cycle (BGCC), pyrolysis, and plasma arc technologies. These technologies expand the application of renewable fuels derived from biomass.

1.8 Bioenergy Research

Increase funding for bioenergy research, including the production of sustainable feedstocks, collection/processing/transport systems, and end-use technologies. The Biosciences Authority is a potential source of funding for this type of research.

AFW-2. AGRICULTURE—LIVESTOCK

2.1.1 Manure Management—Manure Utilization

Implement manure management practices that reduce GHG emissions associated with manure handling and storage. Potential practices include (but are not limited to) manure composting (to reduce methane emissions), manure crusting, addition of additives to decrease the amount of nutrients lost and improve methods for application to fields (for reduced nitrous oxide [N_2O] emissions). Application improvements include incorporation into soil instead of surface spraying or spreading.

2.1.2 Manure Management—Manure/Methane Capture

Implement digester and energy recovery projects at CAFOs both to reduce methane emissions and to utilize the energy to displace fossil fuels. (To date, most of these projects have been implemented at dairies and swine operations.)

2.1.3 Manure Management—Rotational Grazing/Improve Grazing Crops and/or Management

Heavy grazing can cause significant soil disturbance and result in carbon losses from soils. Rotational grazing, where animals are moved from field to field on a regular basis, reduces soil disturbance and maintains soil carbon levels. Rotational grazing also can improve plant vigor and enhance soil carbon levels.

2.1.4 Manure Management—Utilize Biofilters To Control CAFO Emissions

The utilization of collection and control equipment, such as biofilters at CAFOs, can reduce methane emissions.

2.1.5 Manure Management—Increase Pasturing and Lower Densities

Increasing the area over which manure is deposited has the potential to reduce emissions of methane, since the manure is more likely to be decomposed aerobically than anaerobically.

2.1.6 Manure Management—Water Quality

Minimize the impact of animal waste lagoons on water quality.

Recent actions in Kansas: There is a field trial for reduction of phosphate in animal waste lagoons, through precipitation of the mineral struvite. Phosphate is a concern for water quality impacts, and the use of distiller's grains in animal feed has increased the concentrations. The phosphate removal project is conducted through Kansas State University (KSU), with support from the Kansas Livestock Association and the Kansas Water Plan.

2.2 Changes in Animal Feed

Livestock emit methane directly as a result of digestive processes (enteric fermentation). Research suggests that changes in the energy content of feed and other dietary changes can reduce methane emissions from enteric fermentation. Optimizing nitrogen (protein) utilization in the feed can reduce nitrogen levels in the manure, which in turn reduces the potential for N_2O emissions.

2.3 Technology Improvements To Increase Water Conservation

Encourage closed-loop systems when siting new construction.

2.4 Technology Improvements To Increase Efficiency (Livestock)

Improvements in dairy or other livestock production practices can lead to lower energy consumption per animal unit or other commodity unit. This lower energy consumption per unit can lead to lower GHG emissions.

AFW-3. AGRICULTURE—CROP PRODUCTION

3.1 Soil Carbon Management

The amount of carbon stored in the soil can be increased by the adoption of such practices as conservation, no-till cultivation, and crop rotation. Reducing summer fallow and increasing winter cover crops are complementary practices that reduce the need for conventional tillage. In addition, the application of biochar (i.e., charcoal) may also increase soil carbon content and stabilize soil carbon. By reducing mechanical soil disturbance, these practices reduce the oxidation of soil carbon compounds and allow more stable aggregates to form. Other benefits

include reduced wind and water erosion, reduced fuel consumption, and improved wildlife habitat.

Recent actions in Kansas: KSU professor of agronomy Chuck Rice is a well-known scientist who contributed his expertise on agricultural sequestration to the United Nations Intergovernmental Panel on Climate Change reports. KSU sponsors the Soil Carbon Center (http://soilcarboncenter.k-state.edu/index.html), which disseminates information regarding agricultural carbon sequestration. KSU also participates in the Consortium for Agricultural Soils Mitigation of Greenhouse Gases, sponsored by Colorado State University (http://www.casmgs.colostate.edu/). Many Kansas farmers are involved in no-till practices that sequester carbon and provide revenue through the generation of carbon offset credits. There is intense and widespread interest in the opportunities for Kansas in this area.

There are currently 25 active Watershed Restoration and Protection Strategy (WRAPS) projects in Kansas. The Kansas WRAPS offers a framework that engages citizens and other stakeholders in a teamwork environment aimed at protecting and restoring Kansas watersheds. Many of the activities implemented under the Kansas WRAPS program seek to improve agricultural land management activities.

A 20,000-acre Kansas Upper Arkansas River Conservation Reserve Enhancement Program (CREP) will transition irrigated acres into a conservation planting for a minimum of 14–15 years. As of August 2008, roughly 10,000 acres were being enrolled. CREP is a joint federal–state program, administered by the USDA Farm Service Agency and State Conservation Commission. The state legislature approved the program for up to 40,000 acres.

3.2 Nutrient Management

Improve the efficiency of fertilizer use and other nitrogen-based soil amendments through implementation of management practices and generally accepted agriculture management practices (GAAMPs). Excess nitrogen not metabolized by plants can leach into groundwater and/or be emitted to the atmosphere as N_2O. Better nutrient utilization can lead to lower N_2O emissions from runoff.

3.3 Technology Improvements To Increase Efficiency (Crop Production)

New technologies and cultivation methods have the potential to reduce GHG emissions when fossil fuel or electricity consumption can be reduced. Auto-steer guidance systems are an example, as is auto swath technology, which uses global positioning system (GPS)-based technology to automatically turn the spray boom sections on or off when coming to an area of the field that has been sprayed or needs to be sprayed. Auto swath technology can be used for planting, fertilizing, and other operations. On odd-shaped fields, it can result in a 3%–5% savings. See http://www.agleader.com/products.php?Product=directcommand_l.

Variable-rate fertilizing and liming are also becoming more popular among farmers. The farmer has a local co-op grid sample the field, and then variable-rate technology applies the fertilizer or lime in the areas of the field that need it. The areas of the field that do not need fertilizer or lime

have none applied, which can result in a 50%–60% reduction in the amount of lime or fertilizer needed. See http://www.agleader.com/products.php?Product=directcommand_g.

GreenSeeker normalized difference vegetation index (NDVI) is a promising technology that is still in its early testing stages. A farmer applies 50%–70% of his nitrogen at planting and then, in season, uses GreenSeeker NDVI technology to apply the amount of nitrogen the corn or wheat plant needs when it is growing—a more efficient way of applying nitrogen that will result in less nitrogen being overapplied. See http://www.ntechindustries.com/greenseeker-RT200.html.

Improvements may also be achieved with newer machines with better fuel efficiency, larger planters and combines, and genetically modified seed. Note that this option has a similar counterpart in AFW-5.1 (Increase On-Farm Energy Production and Efficiency).

3.4 Water Management

Improve the efficiency of water use through implementation of best management practices (BMPs) and GAAMPs. Excess water can lead to nitrogen runoff, with subsequent emission to the atmosphere as N_2O. Managing and improving water consumption and nutrients spread on crops will result in a minimal loss of carbon from the soil. Reduced water consumption can result in lower energy use for water pumping.

Recent actions in Kansas: The Kansas State University Research and Extension Mobile Irrigation Lab (MIL) provides educational programs and technical assistance to Kansas agricultural producers. Major components of the MIL program include irrigation decision-support software, fuel type evaluation, and training and in-field evaluation of center-pivot irrigation nozzle packages. MIL is supported in part by the Kansas Water Plan.

KanSched, another KSU farmer support program, assists producers in determining the best time for irrigation. It relies on the daily weather station evapotranspiration information. Producers can get support online or by phone.

The City of Wichita and State Conservation Commission have collaborated on cost share to farmers to implement BMPs, particularly for BMPs to reduce atrazine runoff in the Little Arkansas watershed. It is supported, in part, by the Kansas Water Plan.

The Water Transition Assistance Program (Water TAP) is the state program to purchase and permanently retire water rights in areas overappropriated. Land can be used for dryland cropping, pasture, or other non-irrigated uses. Supported by the Kansas Water Plan, this 5-year pilot program is currently in its second year of enrollment.

The USDA Environmental Quality Incentives Program has enrolled acres in Quick Response Areas (QRAs), providing incentive payments to producers to transition to from irrigation to dryland use. Dryland crops and pasture are allowed. A minimum of 4 years of practice implementation is required, although the water right is not permanently retired. QRAs are in water-short areas that rely on the High Plains Aquifer.

3.5 Drainage Management

Improve drainage on agricultural lands to prevent ponding, which can lead to anaerobic soils and GHG emissions (methane).

3.6 Biotechnology Applications for GHG Mitigation

Use biotechnology advances to increase the yield per acre and reduce the amount of fertilizer and other inputs needed to produce crops important to Kansas.

3.7 Perennial Crop Production

In situations where perennial crop production can supplant annual crop production, gains in soil carbon are possible, which indirectly sequesters CO_2 from the atmosphere. Other net GHG benefits could be gained through lower use of nutrients and water. Both of these typically require energy to deliver to the field and also have their own embedded GHGs (e.g., the energy required to produce, transport, and apply fertilizer).

AFW-4. AGRICULTURE—LAND-USE CHANGE

4.1 Land-Use Management That Promotes Permanent Cover—State Action

State actions for converting marginal agricultural land used for annual crops to permanent cover—such as grassland/rangeland, orchard, or forest—where the soil carbon and/or carbon in biomass is higher under the new land use. Includes state-level opportunities to keep Conservation Reserve Program (CRP) lands covered in perpetuity.

Increased demand for corn-based ethanol and biodiesel feedstocks can act as an incentive for converting grassland to cropland. Adopt mechanisms to prevent these acres from returning either to conventionally tilled production or to suburban/urban development.

Recent actions in Kansas: The 20,000-acre Kansas Upper Arkansas River CREP will transition irrigated acres into a conservation planting for a minimum of 14–15 years. As of August 2008, roughly 10,000 acres were being enrolled. CREP is a joint federal–state program, administered by the USDA Farm Service Agency and State Conservation Commission. The state legislature approved the program for up to 40,000 acres. The primary goal of CREP is water conservation.

"Bioenergy and Water" is a priority issue in the 2008 State Water Plan (Lower Arkansas, Upper Arkansas, and Cimarron basins). The plan recommends providing education and/or incentives to keep acres coming out of CRP in a conservation planting, and targeting watershed with potential impacts by biofuel production for programs to mitigate those impacts, such as stream buffers, grass filters, and BMPs.

4.2 Land-Use Management That Promotes Permanent Cover—State Input on Federal Policy

Work at the state level to influence national policy on converting marginal agricultural land used for annual crops to permanent cover—such as grassland/rangeland, orchard, or forest—where the

soil carbon and/or carbon in biomass is higher under the new land use. Includes opportunities to keep CRP lands covered in perpetuity.

Increased demand for corn-based ethanol and biodiesel feedstocks can act as an incentive for converting grassland to cropland. Adopt mechanisms to prevent these acres from returning either to conventionally tilled production or to suburban/urban development.

4.3 Preserve Open Space/Agricultural Land

Reduce the rate at which agricultural lands are converted to developed uses, while protecting private property rights and responsibilities. This retains the above- and belowground carbon on these lands, as well as their carbon sequestration potential. Transportation emissions will be reduced indirectly through more efficient development and lower vehicle use. Agricultural land conversion may be prevented through conservation land grants and conservation easements facilitated through nonprofit land preservation organizations. A limiting factor for implementing this option is available state funding. Among the implementation options, brownfields development (developing former industrial areas that could be affected by soil/groundwater pollution) can lower the pressure to develop other open space and agricultural lands.

Recent actions in Kansas: Eleven Kansas mayors have joined the U.S. Conference of Mayors Climate Protection Agreement. One of the measures among the mayors who form this partnership is to adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities.

4.4 Prioritize Environmental Remediation Actions for GHG Benefits

An important ancillary benefit of some types of environmental remediation actions could be lower net GHG emissions. For example, in projects where lands have been disturbed and require revegetation as part of the remediation action, the revegetated land should sequester more above- and below-ground carbon after the project is complete. The criteria used to prioritize remediation action should include an assessment of GHG benefits.

AFW-5. AGRICULTURE—FARMING PRACTICES

5.1 Increase On-Farm Energy Production and Efficiency

Renewable energy can be produced and used on site at agricultural operations. For example, installing solar or wind power; using hydropowered generators for irrigation; converting diesel farm equipment to liquefied natural gas, compressed natural gas, or hybrid technology; increasing on-farm use of biofuels and other renewables; expanding farm energy audit programs; and updating machinery, equipment, and engines will reduce carbon dioxide (CO_2) emissions by displacing the use of fossil-based fuels.

Recent actions in Kansas: A 20,000-acre Kansas Upper Arkansas River CREP will transition irrigated acres into a conservation planting for a minimum of 14–15 years. Energy conservation is one of the objectives of this CREP, with the potential energy savings of 8 million kilowatt-hours, with the retirement of center pivots on 20,000 acres.

5.2 Promotion of Farming Practices That Achieve GHG Benefits

Provide incentives to farmers for using production processes that achieve net GHG benefits. For example, use biotech crops or other farming practices that could achieve reduced GHG emissions compared to conventional farming, depending on the specific practices implemented (e.g., use of no-till cultivation and fewer chemical inputs).

5.3 Programs To Support Local Farming/Buy Local

Promote the production and consumption of locally produced agricultural goods, including transportation and heating fuels and plastics, which displace the consumption of those transported from other states or countries. GHG reductions occur from reduced transportation-related emissions.

5.4 Promotion of Urban Agriculture, Community Gardens, Green Roofs, and Locally Sourced School Foods

Promote participation in urban agriculture programs that reduce GHGs by sequestering carbon, and reduce cooling costs by mitigating urban heat islands. Programs also reduce transportation-related emissions by reducing food miles for urban consumers. Promote urban agriculture on vacant or abandoned lands. Promotion of locally sourced food for schools reduces food-miles and the associated energy consumption and GHG emissions.

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

Increase the amount of biomass available from forests for generating electricity and displacing the use of fossil energy sources. Note: This is related to AFW-1.1 (agricultural biomass) and AFW-9.1 (waste biomass).

Recent actions in Kansas: The state's largest utility, Topeka-based Westar, announced on February 26, 2007, an RFP for 500 MW of renewable energy. While this target may be largely comprised of wind energy, the RFP is not specific to wind and may include biomass resources.

With Executive Order 08-04, the Governor instructed the Kansas Energy Council to "collect and compile information pertaining to energy resources, including wind and biomass, in the state, as well as the availability, production and use of energy in the state."

6.2 In-State Liquid Biofuels Production

Increase production of ethanol and/or biodiesel fuel from rangeland and forestry feedstocks (raw materials) to displace the use of fossil fuel. Promote the development of cellulosic ethanol technologies and ethanol production systems that use renewable fuels to improve the embedded energy content of ethanol. Increased in-state production and consumption give the highest benefits. Note: This is related to AFW-1.2 (agricultural biofuels) and AFW-9.2 (waste biofuels).

Recent actions in Kansas: On January 14, 2008, in her State of the State address, the Governor recommended the creation of a Bioenergy Research Grant Program to spur development of innovative technologies producing the most cost-efficient renewable fuels. She also charged the Kansas Bioscience Authority with developing an aggressive plan for bioenergy technology and production, aimed at producing 20% of the nation's alternative fuel needs.

PFBF Coop established an office in Healy, Kansas. PFBF'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

Reduce emissions and increase efficiency from heat sources, such as wood-burning stoves and furnaces.

6.4 Improved Commercialization of Biomass Conversion Technologies

Improve the rate of technology development and market deployment of biomass conversion technologies, including BGCC, pyrolysis, and plasma arc technologies. These technologies expand the application of renewable fuels derived from biomass. The U.S. Department of Energy's National Renewable Energy Laboratory is a good place to start to gain an understanding of some of these technologies (http://www.nrel.gov/biomass/proj_thermochemical_conversion.html). The California Integrated Waste Management Board also maintains information on biomass conversion technologies (http://www.ciwmb.ca.gov/organics/conversion/).

6.5 Expanded Use of New, Reused, and Recycled Bio-Based Products for Building Materials

Increase the amount of renewable wood and other bio-based products used for residential and commercial building. Using wood products in place of other building materials can increase carbon sequestration in wood products and displace GHG emissions associated with processing high-energy-input materials, such as steel, plastic, and concrete. Reduction potential is enhanced by promoting the use of locally grown wood because it has lower transport-associated emissions. Promote utilization of recycled or reusable wood products to reduce wood waste. Encourage certification programs, such as the Leadership in Energy and Environmental Design Green Building Rating System™, to put wood on an equal footing with other materials.

AFW-7. RANGELAND AND FORESTRY—BIOMASS PROTECTION AND MANAGEMENT

7.1 Rangeland and Forest Protection—Reduced Clearing and Conversion to Non-Forest Cover

Reduce the rate at which existing forests are cleared and converted to developed uses. Much of the carbon stored in forest biomass and soils can be lost as a result of such land-use conversion. Easements can be used toward this end, as well as conservation programs.

Recent actions in Kansas: In the 2008 update of the Kansas Water Plan, the Kansas Water Office is developing a policy to promote better protection of forested riparian areas through enhanced use of conservation easements.

7.2 Urban Forestry

Maintain and improve the health and longevity of trees in urban and residential areas to protect and enhance the carbon stored in tree biomass. Indirect emission reductions may also occur by reducing heating and cooling needs as a result of planting shade trees. Promote use of software programs that can be used by cities and communities to track urban forestry. Need to be sensitive to greenbelt taxing issues.

Recent actions in Kansas: Eleven Kansas mayors have joined the U.S. Conference of Mayors Climate Protection Agreement. One of the measures among mayors acceding to the agreement is to maintain healthy urban forests, promote tree planting, and increase shading.

Kansas has 113 cities and towns receiving state and national recognition as Tree City USAs. Tree City USA communities must meet national standards for managing public trees. Westar, the state's largest utility, has earned certification as a Tree Line USA Utility Company for nine years.

7.3 Afforestation and/or Restoration of Non-Forested Land

Establish forests on land that has not historically been forested (e.g., agricultural land; "afforestation"). Promote forest cover and associated carbon stocks by regenerating or establishing forests in areas with little or no present forest cover ("reforestation"). In addition, implement such practices as soil preparation, erosion control, and stand stocking to ensure conditions that support forest growth.

7.4 Rangeland and Forest Management for Carbon Sequestration

Encourage forest management activities that promote forest productivity and increase the rate of CO_2 sequestration in forest biomass and soils and in harvested wood products. Practices may include increased stocking of poorly stocked lands, age extension of managed stands, thinning and density management, fertilization and waste recycling, expansion of short-rotation woody crops (for fiber and energy), expanded use of genetically preferred species, modified biomass removal practices, fire management and risk reduction, and pest and disease management.

7.5 Mitigation of Carbon Sequestration Loss and Emissions Due to Wildfire

Programs that reduce the potential for and severity of wildfires also reduce GHG emissions by lowering the forest carbon lost during the fire, in addition to the subsequent losses of carbon sequestration potential in the area affected by wildfire. Prescribed fires may increase carbon in soil. Mechanical removal of biomass may provide sources of biomass that can be used for conversion to energy.

7.6 Mitigation of Forest Loss Due to Insects/Disease

Programs that reduce insect damage to forests also reduce GHG emissions by maintaining the carbon sequestration achieved in healthy forests.

Recent actions in Kansas: Kansas Department of Agriculture, Plant Protection and Quarantine coordinates with USDA, Kansas Forest Service, and other stakeholders in the identification of plant pests that may impact forests in Kansas, such as the organism responsible for Sudden Oak Death.

AFW-8. RANGELAND AND FORESTRY—BIOMASS INDUSTRY

8.1 Improved Mill Waste Recovery—Utilization of Sawmill Residues and Emissions

Improve treatment and cleaning of waste materials from paper mills, which can then be reused to manufacture additional wood products. Ensure that sawmill by-products are recycled or beneficially used for energy. Note: this option links to AFW-6.1 (forest biomass) and AFW-6.3 (wood waste).

8.2 Improved Logging Residue Recovery

Use more efficient logging methods to fully utilize harvested trees, which will minimize carbon losses from wood damaged during harvesting and maximize the potential for carbon sequestration in harvested wood products. Process the logging remains efficiently.

8.3 Silviculture Improvements

Adopt water conservation, improved harvesting technology such as improved equipment, and other GHG-reducing agricultural practices that can be applied to silviculture. Maximize compliance with programs.

AFW-9. WASTE MANAGEMENT—WASTE MANAGEMENT STRATEGIES

9.1 Expanded Use of MSW Waste Biomass Feedstocks for Electricity, Heat, and Steam Production

Increase the amount of biomass from the municipal solid waste (MSW) stream available for generating electricity and displacing the use of fossil energy sources. Local electricity or steam production yields the greatest net energy payoff. Note: This is related to AFW-1.1 (agricultural biomass) and AFW-6.1 (forestry biomass).

Recent actions in Kansas: The state's largest utility, Topeka-based Westar, announced on February 26, 2007, an RFP for 500 MW of renewable energy. While this target may be largely comprised of wind energy, the RFP is not specific to wind and may include biomass resources.

With Executive Order 08-04, the Governor instructed the Kansas Energy Council to "collect and compile information pertaining to energy resources, including wind and biomass, in the state, as well as the availability, production and use of energy in the state."

9.2 In-State Liquid Biofuels Production

Increase production of ethanol and/or biodiesel fuel from agriculture and/or forestry feedstocks and/or municipal solid and other waste (raw materials) to displace the use of fossil fuel. This is related to AFW-1.2 (agricultural biofuels) and AFW-6.2 (forestry biofuels).

Recent actions in Kansas: On January 14, 2008, in her State of the State address, the Governor recommended the creation of a Bioenergy Research Grant Program to spur development of innovative technologies producing the most cost-efficient renewable fuels. She also charged the Kansas Bioscience Authority with developing an aggressive plan for bioenergy technology and production, aimed at producing 20% of the nation's alternative fuel needs.

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9.3 Advanced Recycling and Composting

Increase recycling and reduce waste generation in order to limit GHG emissions associated with landfill methane generation and with the production of raw materials. Increase recycling programs, create new recycling programs, provide incentives for the recycling of construction materials, develop markets for recycled materials, and increase average participation and recovery rates for all existing recycling programs.

Recent actions in Kansas: In 2007, Governor Sebelius issued an Executive Directive (07-373) to all state agencies and facilities aimed at improving energy conservation and management. Included in the directive was the implementation of a recycling program in every state office building by December 2007.

In 2008, the state agencies are implementing a paper reduction effort. State natural resource agencies are making an informal effort to increase car pooling to meetings, and use of teleconferences to reduce total travel.

9.4 Promotion of Bioreactor Technology (Advanced Municipal Solid Waste Management Practices)

A bioreactor landfill is essentially an in-landfill composting activity at a Subtitle D (MSW) sanitary landfill in which liquid, temperature, and air (for aerobic processes) are managed in a controlled manner to achieve rapid stabilization of the food, green-waste, and paper-waste constituents. To optimize the rapid stabilization of these wastes, moisture, gas composition, gas flow, and temperature must be carefully maintained and monitored. Bioreactor technology is used to accelerate waste stabilization, enhance gas production and collection, control leaching, reduce volume, and minimize the long-term liability of waste.

9.5 Source Reduction Strategies

Reduce the volume of waste from residential, commercial, and government sectors through programs that reduce the generation of wastes. Reducing generation at the source reduces both landfill emissions and upstream production emissions.

9.6 Resource Management Contracting

Unlike traditional solid waste service contracts, resource management (RM) compensates waste contractors based on performance in achieving an organization's waste reduction goals, rather than the volume of waste disposed. As a result, RM aligns waste contractor incentives with the goals to explore innovative approaches that foster cost-effective resource efficiency through prevention, recycling, and recovery.

9.7 Enhanced Management of Organic Waste

Reduce methane emissions associated with landfilling by reducing the biodegradable fraction of waste emplaced. Recently, an area of focus in the solid waste industry has been increasing recycling of organic wastes (e.g., lawn and garden waste, food waste, wood, paper, and bio-based plastics) using different conversion technologies, including composting, anaerobic digestion, or hybrids of these technologies.

9.8 Improved Commercialization of Biomass Conversion Technologies

Improve the rate of technology development and market deployment of biomass conversion technologies, including BGCC, pyrolysis, and plasma arc technologies. These technologies expand the application of renewable fuels derived from biomass. A range of renewable products can be developed from these processes, including gaseous and liquid fuels, biochar, chemical products, and methane to methanol. Existing processes include waste combustion and energy recovery (as electricity, steam, or both) or ethanol plants using co-products for heating and drying, rather than relying on outside energy sources.

AFW-10. WASTE MANAGEMENT—LANDFILL GAS STRATEGIES

10.1 Flare Landfill Methane at Non-NSPS (Smaller) Sites

Encourage smaller landfills that do not fall under environmental protection regulations (i.e., new-source performance standards [NSPS]) to capture and flare methane gas. Flares are used to safely combust toxic and volatile gases from landfills, and they convert methane gas, which has a relatively high global warming potential, to CO_2.

10.2 Methane and Biogas Energy Programs

Encourage and promote the use of anaerobic digesters and energy recapture for waste materials other than MSW at landfills (e.g., food processing waste). These projects will help prevent the emission of methane while producing clean energy. Anaerobic digesters make a twofold contribution to climate protection: they prevent the usual unchecked discharge of methane into the atmosphere, and replace the burning of fossil fuels with renewable energy (biogas).

Recent actions in Kansas: Eleven Kansas mayors have joined the U.S. Conference of Mayors Climate Protection Agreement. One of the measures among mayors acceding to this partnership is to increase the use of clean, alternative energy by, for example, investing in "green tags," advocating for the development of renewable energy resources, recovering landfill methane for energy production, and supporting the use of waste-to energy-technology.

10.3 Landfill Methane Energy Programs

Use the renewable energy created at landfills by anaerobic digesters (methane) to make electric power, space heat, or liquefied natural gas.

AFW-11. WASTE MANAGEMENT—WASTEWATER MANAGEMENT ACTIVITIES

11.1 Wastewater Treatment Plant Biosolids for Energy Production

Develop and implement methods for processing and using biosolids as a renewable energy source—for example, as a renewable fuel to be co-fired with other fuels in existing or new combustion units for the purpose of generating electricity, heat, or steam.

Recent actions in Kansas: Eleven Kansas mayors have joined the U.S. Conference of Mayors Climate Protection Agreement. One of the measures among mayors acceding to this partnership is to evaluate opportunities to increase pump efficiency in water and wastewater systems and recover wastewater treatment methane for energy production.

11.2 Energy Efficiency Improvements

Provide incentives for efficiency improvements. Encourage the setup of energy policies, energy audits, and energy cost tracking. Identify and implement energy improvements, such as using energy-efficient equipment and generating on-site power (e.g., solar power).

The term "efficiency improvements" is defined, within the scope of wastewater management activities, as:

- Conversion of secondary aeration processes to fine-bubble diffusion and optimization of oxygen transfer efficiencies;
- Research and development (R&D) of diffuser cleaning protocols;
- R&D to increase removal of chemical oxygen demand in primary treatment tanks and clarifiers;
- Evaluation of steam use in plant processes and biofilters, optimization of use, and promotion of alternatives; and
- R&D of options to optimize denitrification in secondary treatment.

Financial and performance analyses that may be conducted to assist the implementation of this option include:

- Create a leveraged state revolving loan fund program to capitalize energy efficiency in municipal wastewater treatment plants.
- Conduct benchmarking of energy use per million gallons treated in Kansas to showcase good and deficient energy performance in this specific climate.

May also include researching ways to use wastewater biomass as an energy source, rather than just as a soil carbon source.

Recent actions in Kansas: The Kansas Facility Conservation Improvement Program is responsible for administering a grant program aimed at reducing building energy use.

11.3 Lower Waste Processing Needs (Lower Water Consumption, Waste Production)

Develop and implement best practices for lowering water consumption and lowering waste production in the industrial, commercial, and residential sectors. Encourage and create incentives for R&D on methods or technologies to reduce water consumption and waste production. Provide education to reduce water consumption and waste production. Lower water consumption and waste production lead to lower GHG emissions.

11.4 Install Digesters and Turbines or Engines

Provide incentives to install anaerobic digesters to treat municipal waste and create methane. Install turbines or reciprocating engines to generate electricity from the methane. Reductions occur via methane control and offsetting fossil energy use. Provide incentives to recover heat from wastewater influent or effluent through the use of heat pumps. Investigate opportunities for waste heat recovery from biogas combustion units (turbines, engines, flares).

11.5 Algae and Bio-Oils

Provide financial incentives to research the production of bio-oils from algae or other microorganisms grown in wastewater effluents (which would reduce carbon, nitrogen, and phosphorus). This option would most likely be developed under AFW-1.2 (In-State Liquid Biofuels Production).

11.6 Use of Wetlands for Energy Efficiency and Carbon Sequestration

Using wetlands as part of a wastewater treatment system can lower energy consumption compared to conventional treatment processes. There is also additional potential for constructed wetlands to sequester more carbon than the previous land use.