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Agriculture, Forestry, and Waste Management (AFW) Technical Work Group

Summary List of Pending Priority Policy Options for Analysis

Option No.	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2009–2025 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2015	2025	Total 2009–2025			
AFW-1	Manure Management	*Not Yet Quantified*					Pending
AFW-2	Promotion of Farming Practices That Achieve GHG Benefits	*Not Yet Quantified*					Pending
AFW-3	Improved Water Management and Use	*Not Yet Quantified*					Pending
AFW-4	Expanded Use of Agriculture and Forestry Biomass Feedstocks for Electricity, Heat, or Steam Production	*Not Yet Quantified*					Pending
AFW-5	Expanded Use of In-State Liquid Biofuels	*Not Yet Quantified*					Pending
AFW-6	Expanded Use of Locally Produced Farm and Forest Products	*Not Yet Quantified*					Pending
AFW-7	Forest Management and Establishment for Carbon Sequestration	*Not Yet Quantified*					Pending
AFW-8	Advanced Recovery and Recycling	*Not Yet Quantified*					Pending
AFW-9	End-of-Use Waste Management Practices	*Not Yet Quantified*					Pending

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent.

Note: The numbering used to denote the above pending priority policy options is for reference purposes only; it does not reflect prioritization among these important draft policy options.

Table 1. Biomass Supply Assessment

Biomass Resource	Annual Biomass Supply (10^3 dry short tons)	Heat Content (MMBtu/dry short ton)	Approximate Energy Available (MMBtu)	Notes
Forest Residue	5,265	9.961	52,448,370	Biomass availability from Annual Biomass Supply Study.[1] Heat Content from Biomass Heat Content Study.[2]
Mill Residue	3,239	9.961	32,263,679	Annual Biomass Supply Study. Heat Content from Biomass Heat Content Study.
Urban Wood Waste	1,534	9.961	15,281,947	Annual Biomass Supply Study. Heat Content from Biomass Heat Content Study.
Agricultural Residue	3,198	8.248	26,378,630	Annual Biomass Supply Study. Heat Content from Biomass Heat Content Study.
Municipal Paper Waste	293	13.03	3,813,568	Annual Biomass Supply Study. Heat Content from Biomass Heat Content Study.
Municipal Solid Waste (MSW) Fiber	TBD	9.945	TBD	Annual Biomass Supply Study. Heat Content from Biomass Heat Content Study.
Used Cooking Oil	4	TBD	TBD	Annual Biomass Supply Study. Heat Content from Biomass Heat Content Study.
Yard & Landscape Waste Debris	87	9.961	865,495	Annual Biomass Supply Study. Heat Content from Biomass Heat Content Study. Moisture contents from Wyoming study.[3]
Biosolids	41	TBD	TBD	Annual Biomass Supply Study. Heat Content from Biomass Heat Content Study.
Energy Crops	TBD	TBD	TBD	Annual Biomass Supply Study. Heat Content from Biomass Heat Content Study.
Total Annual Biomass Supply	**13,661**	**N/A**	**131,051,689**	**Note that this does not include energy crops.**

[1] Arkansas Economic Development Commission, Annual Biomass Supply: Arkansas Biomass Resource Assessment, Arkansas http://arkansasedc.com/business_development/energy/?page=bioenergy

[2] U.S. Department of Energy, Energy Information Administration, "Average Heat Content of Selected Biomass Fuels," April 2008. Available at:

http://www.eia.doe.gov/cneaf/solar.renewables/page/trends/table10.html.

[3] Moisture contents for paper waste (5%) and yard waste (40%) from: Wyoming Business Council, *Municipal Solid Waste*. Available at: http://www.wyomingbusiness.org/pdf/energy/Biomass_MunicipalWaste.pdf.

Table 1. Biomass Supply Assessment (continued)

Policy Requiring Biomass	2025 Annual Biomass Demand (10^3 dry short tons)	Heat Content (MMBtu/dry short ton)	Approximate Energy Available (MMBtu)	Notes
AFW-4	TBD	N/A	N/A	10% of available agriculture residue biomass by 2025. 10% of available in-state forest residue by 2025. 10% of marginal agriculture land by 2025. 10% of available methane from livestock manure and poultry litter.
AFW-5	TBD	N/A	N/A	10% of biomass supply to produce biofuels.

MMBtu = million British thermal units; N/A = not applicable; TBD = to be determined.

AFW-1. Manure Management

Policy Description

Potential manure management practices that reduce greenhouse gas (GHG) emissions associated with manure handling and storage include manure composting to reduce methane (CH_4) emissions, movement of manure from nutrient-rich to nutrient-deficient areas, and improved methods for application to fields (for reduced nitrous oxide [N_2O] emissions). Application improvements include incorporating manure into soil instead of surface spraying or spreading. Also, implementing digester and energy recovery projects at confined animal operations reduces methane emissions and uses the energy to displace fossil fuels. To date, most of these projects have been implemented at dairies and swine operations.

Policy Design

Goals: Reduce CH_4 and N_2O emissions from dairy, hog, and poultry operations by 40% by 2025, through improved manure handling and storage practices..

Timing: As described above.

Parties Involved: To be determined (TBD) – [as approved by the TWG]

Other: Previous studies have determined that deep stacking litter produces significant N_2O emissions (deep stacking litter is very similar to composting). While composting may lower methane (CH_4) emissions, it will probably raise N_2O emissions. This process also generates and wastes ammonia emissions.

Velthof et al. (2004) found that more N_2O was emitted when manure was incorporated into soil compared to applied the surface. They looked at applying manure at different depths, but found surface application was the best. It is suspected that incorporating manure into soil increases the potential for denitrification. Nevertheless, incorporating manure into soil may still be considered good practice, as it reduces nutrient runoff and ammonia emissions and improves nitrogen uptake.

Implementation Mechanisms

TBD – [as approved by the Technical Work Group (TWG)]

Related Policies/Programs in Place

Poultry Litter

Act 1061 (HB 1654)—The act declares various areas of Arkansas to be nutrient surplus areas for phosphorus and nitrogen, authorizes the Arkansas Soil and Water Conservation Commission to make rules concerning management of nutrients in nutrient surplus areas, and creates penalties for violations of the act.

Poultry Feeding—Management Plans

Act 2294 (SB 1160)—This act requires that, after January 1, 2007, poultry litter be applied to soils or associated crops within a nutrient surplus area in accordance with a nutrient management plan or poultry litter management plan.

Type(s) of GHG Reductions

- **CH_4:** Captures and utilizes methane or prevents the creation of methane.
- **N_2O:** Reductions occur when nitrogen runoff and leaching are reduced. (Runoff and leaching lead to the formation and emission of N_2O.)

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: [TBD, as approved by the TWG]

Quantification Methods: [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as approved by the TWG]

Key Uncertainties

TBD – [as needed and approved by the TWG]

Additional Benefits and Costs

TBD – [as needed and approved by the TWG]

Feasibility Issues

TBD – [as needed and approved by the TWG]

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #7 or #8]

Level of Group Support

TBD – [blank until Governor's Commission on Global Warming (GCGW) meeting #7 or #8]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

AFW-2. Promotion of Farming Practices That Achieve GHG Benefits

Policy Description

The state could provide incentives to farmers for using production processes that achieve net GHG benefits. For example, some organic farming practices could reduce GHG emissions compared to conventional farming, depending on the specific practices implemented (e.g., use of no-till cultivation and fewer chemicals).

Policy Design

Goals:

- By 2025, implement cultivation practices to enhance soil carbon levels on 40% of the acreage that is not already using these practices.
- By 2025, implement cultivation practices to increase nutrient efficiency by 20%.

Timing: As described above.

Parties Involved: TBD – [as approved by the TWG]

Other: TBD – [as needed and approved by the TWG]

Implementation Mechanisms

TBD – [as approved by the TWG]

Related Policies/Programs in Place

TBD – [as needed and approved by the TWG]

Type(s) of GHG Reductions

Carbon Dioxide (CO_2): Improved efficiency can reduce electricity and fuel consumption and the associated GHGs.

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: [TBD, as approved by the TWG]

Quantification Methods: [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as approved by the TWG]

Key Uncertainties

TBD – [as needed and approved by the TWG]

Additional Benefits and Costs

TBD – [as needed and approved by the TWG]

Feasibility Issues

TBD – [as needed and approved by the TWG]

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #7 or #8]

Level of Group Support

TBD – [blank until GCGW meeting #7 or #8]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

AFW-3. Improved Water Management and Use

Policy Description

Using surface water and versus groundwater and decreasing water consumption reduces pumping and energy consumption, in addition to other ancillary benefits. Implementing best management practices improves the efficiency of water use. Additionally, excess surface water can lead to runoff of nitrogen, with subsequent emission of N_2O to the atmosphere. Managing and improving water consumption and nutrients spread on crops will result in a minimal loss of carbon from the soil. Reusing water can create nutrient management problems and must be considered when implemented. Water purification is an energy-intensive process that is an issue for farmers and land users in addition to other sectors, such as the residential, commercial and industrial sector (this is related to options under RCI Technical Work Group [TWG]). As such, water use in rural, suburban, and urban areas should be included under this policy option. The impact of catfish farms on GHG emissions could also be investigated under this option.

Policy Design

Goals:

- Increase the use of surface water for irrigation by 10% by 2025, compared to business as usual (reducing energy consumption associated with groundwater pumping).
- Decrease energy use for water purification by 20% in 2025, compared to business as usual (includes efficiency gains from reducing water and energy consumption).

Timing: As described above.

Parties Involved: TBD – [as approved by the TWG]

Other: TBD – [as needed and approved by the TWG]

Implementation Mechanisms

TBD – [as approved by the TWG]

Related Policies/Programs in Place

Through Act 341 of 1995, Arkansas has invested significant funding and technical support (in addition to local and federal funding) toward using surface water as opposed to groundwater. Three projects currently under way are:

- Bayou Metro Water Management District,
- Boeuff Tensas Water Management District, and
- White River Irrigation District.

Each of the above projects is in various stages of development toward realizing their goals to use surface water instead of groundwater for irrigation.

Type(s) of GHG Reductions

- **CO_2:** Less energy used to pump water results in reduced CO_2 emissions.
- **N_2O:** Reductions occur when nitrogen runoff and leaching are reduced. (Runoff and leaching lead to the formation and emission of N_2O.)

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: [TBD, as approved by the TWG]

Quantification Methods: [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as approved by the TWG]

Key Uncertainties

TBD – [as needed and approved by the TWG]

Additional Benefits and Costs

TBD – [as needed and approved by the TWG]

Feasibility Issues

TBD – [as needed and approved by the TWG]

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #7 or #8]

Level of Group Support

TBD – [blank until GCGW meeting #7 or #8]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

AFW-4. Expanded Use of Agriculture and Forestry Biomass Feedstocks for Electricity, Heat, or Steam Production

Policy Description

Increasing the amount of biomass available from forests or agriculture for generating electricity can displace the use of fossil energy sources. This strategy also encourages the capture of waste heat at facilities using biomass (or fossil fuels), wherever possible. The waste heat could be used for cogeneration of electricity or other purposes that displace fossil fuel use. Arkansas could 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.

Policy Design

Goals:

- *Agricultural Residues:* Increase the use of agricultural residues for electricity, steam, and heat generation to utilize 5% of available in-state agricultural residue biomass by 2015 and 10% of available biomass by 2025.
- *Forest Residues:* Increase the use of forest residues for electricity, steam, and heat generation to utilize 5% of available biomass by 2015, and 10% of available in-state forest residue by 2025.
- *Energy Crops:* Increase the production of energy crops to produce biomass feedstock for electricity, steam, and heat generation by increasing acreage devoted to energy crops to 10% of marginal agricultural land by 2025.
- *Methane From Livestock Manure and Poultry Litter:* By 2025, utilize 10% of available energy from livestock manure and poultry litter for renewable electricity, heat, and steam generation. *[Note potential overlap with AFW-1.]*
- *Capture of Waste Heat:* By 2025, ensure that facilities using biomass for electricity, heat, and steam production are capturing and utilizing 10% of waste heat.

Timing: As described above.

Parties Involved: TBD – [as approved by the TWG]

Other: TBD – [as needed and approved by the TWG]

Implementation Mechanisms

TBD – [as approved by the TWG]

Related Policies/Programs in Place

Electric Public Utility Renewable Energy Resources

Act 755 (HB 2812)—The act authorizes the Arkansas Public Service Commission (PSC) to require a regulated electric public utility to consider renewable energy resources as part of its

resource plan. If the PSC approves the renewable energy resource, it may allow the utility to implement a surcharge to recover a portion of the cost of that resource.

Type(s) of GHG Reductions

CO_2, N_2O, CH_4: Displaces emissions from fossil fuel combustion.

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: [TBD, as approved by the TWG]

Quantification Methods: [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as approved by the TWG]

Key Uncertainties

TBD – [as needed and approved by the TWG]

Additional Benefits and Costs

TBD – [as needed and approved by the TWG]

Feasibility Issues

TBD – [as needed and approved by the TWG]

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #7 or #8]

Level of Group Support

TBD – [blank until GCGW meeting #7 or #8]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

AFW-5. Expanded Production and Use of In-State Biofuels

Policy Description

This strategy increases production of ethanol and/or biodiesel fuel from agriculture and/or forestry feedstocks (raw materials) to displace the use of fossil diesel. It promotes 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 result in the highest benefits.

Policy Design

Goals: Maximize the production of liquid biofuels in Arkansas, such that by 2025 the state utilizes approximately 10% of available biomass supply per year to produce biofuels with significantly lower embedded GHG emissions compared to conventional fuel products (from a life-cycle perspective).

Timing: The above goal identifies a time frame to achieve the final utilization goal. However, the Governor's Commission on Global Warming (GCGW) has suggested that the Agriculture, Forestry, and Waste Management (AFW) TWG investigate the level of development of relevant biofuel technologies. Using this information, the AFW TWG should determine an appropriate commercialization pathway for Arkansas, including identifying when the technology will most likely become commercially available.

Parties Involved: TBD – [as approved by the TWG]

Other: TBD – [as needed and approved by the TWG]

Implementation Mechanisms

TBD – [as approved by the TWG]

Related Policies/Programs in Place

Biodiesel Suppliers and Producers

Act 87 (26-52-401)—The act provides a tax credit for biodiesel suppliers in Arkansas, and incentives in the form of grants for biodiesel producers in the state.

Alternative Fuels Development Program

Act 873 (HB 1379)—The act creates the Arkansas Alternative Fuels Development Program, to be administered by the Arkansas Agriculture Department, with the purpose of providing grant incentives for alternative fuels producers, feedstock processors, and alternative fuels distributors. The act also creates the Arkansas Alternative Fuels Development Fund and repeals obsolete sections of the Arkansas Code related to alternative fuels.

Type(s) of GHG Reductions

CO_2: Life-cycle emissions are reduced to the extent that biofuels are produced with lower embedded fossil-based carbon than conventional (fossil) fuel. Feedstocks used for producing biofuels can be made from crops or other biomass, which contain carbon sequestered during photosynthesis (e.g., biogenic or short-term carbon).

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: [TBD, as approved by the TWG]

Quantification Methods: [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as approved by the TWG]

Key Uncertainties

TBD – [as needed and approved by the TWG]

Additional Benefits and Costs

TBD – [as needed and approved by the TWG]

Feasibility Issues

TBD – [as needed and approved by the TWG]

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #7 or #8]

Level of Group Support

TBD – [blank until GCGW meeting #7 or #8]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

AFW-6. Expanded Use of Locally Produced Farm and Forest Products

Policy Description

The production and consumption of locally produced agricultural goods displace the consumption of goods transported from other states or countries, and thus reduce transportation-related GHG emissions. Increasing the amount of renewable wood products used for residential and commercial buildings can increase carbon sequestration in wood products and displace GHG emissions associated with processing high-energy input materials, such as steel, plastic, and concrete. Also, using locally grown wood can lower transportation-associated GHG emissions.

Policy Design

This policy option places responsibility on local governments to be part of the solution by ensuring that zoning does not preclude intelligent, sustainable uses that support this objective, such as constraining local value-added mills or limiting location/participation in local markets.

Goals:

- *Farmer's Market*: Increase the number of local farmer's markets in Arkansas by 10% by 2025.
- *Local Produce*: Of the food Arkansans consumes, grow or produce 10% locally by 2025.
- *Locally Grown and Processed Wood Products*: Displace the amount of imported wood products with locally grown and processed products by 15% by 2015 and 30% by 2025.

Timing: As described above.

Parties Involved: TBD – [as approved by the TWG]

Other: TBD – [as needed and approved by the TWG]

Implementation Mechanisms

TBD – [as approved by the TWG]

Related Policies/Programs in Place

Energy and Natural Resource Conservation Act

The act encourages the use of wood in green buildings and requires certain state buildings to meet specified environmental construction standards (AR Code 22-3-1801). The Leadership in Energy and Environmental Design Green Building Rating System™ (LEED) was reformed in Arkansas to explicitly encourage the use of wood products in green buildings. (Previously it was eligible, but not encouraged.) Initiated by the Arkansas legislature and subsequently adopted by a number of other states, this reform specifically includes the use of products that promote the sequestration of carbon.

Type(s) of GHG Reductions

CO_2: Extends carbon sequestration in durable wood products and wood construction. Maintains carbon sequestration in healthy forests. Avoids emissions through reduced transportation miles and use of high-energy-input construction materials.

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: [TBD, as approved by the TWG]

Quantification Methods: [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as approved by the TWG]

Key Uncertainties

TBD – [as needed and approved by the TWG]

Additional Benefits and Costs

TBD – [as needed and approved by the TWG]

Feasibility Issues

TBD – [as needed and approved by the TWG]

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #7 or #8]

Level of Group Support

TBD – [blank until GCGW meeting #7 or #8]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

AFW-7. Forest Management and Establishment for Carbon Sequestration

Policy Description

This strategy establishes forests on land not currently forested, such as agricultural land ("afforestation"); promotes retaining forest cover and associated carbon stocks by regenerating forests ("reforestation" or "restoration"); helps maintain and improve the health and longevity of trees in urban and residential areas (urban forestry); and implements, in a carbon-sensitive manner, such practices as site preparation, erosion control, and stand stocking to ensure conditions that support forest growth. Forest management activities promote forest productivity and increase the rate of CO_2 sequestration in forest biomass and soils and in harvested wood products. Also, specific trees could be selected that sequester other non-GHG chemicals in addition to sequestering CO_2. Practices may include increased stocking of poorly stocked lands, age extension of managed stands, thinning, fertilization and waste recycling, expanded short rotation of 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.

Policy Design

Education and outreach especially for citizens and land managers will be an important part of this goal, both to underscore the importance of forests and to teach forest management practices that promote carbon sequestration.

Goals:

- Implement urban tree-planting and -retention programs to increase the number of urban trees by X by 2015 and by X by 2025.
- Implement sustainable forest management practices to achieve carbon benefits on 50% of privately owned land by 2025.
- Implement sustainable forest management practices to achieve carbon benefits on 50% of state-owned resource lands by 2025.
- Restore/establish X,000 acres of forest by 2015 and X,000 acres by 2025.
- Sustain existing forests to ensure no net loss of existing forests.

Timing: As described above.

Parties Involved: TBD – [as approved by the TWG]

Other: TBD – [as needed and approved by the TWG]

Implementation Mechanisms

TBD – [as approved by the TWG]

Related Policies/Programs in Place

TBD – [as needed and approved by the TWG]

Type(s) of GHG Reductions

CO_2: Removes fuels that contribute to wildfire emissions. Maintains carbon sequestration through the production of durable wood products. Reduces emissions by reducing the use of fossil fuels replaced by energy from woody biomass, and by preventing the release of carbon from dead and dying trees. Reduces wildfire emissions by maintaining healthy forests.

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: [TBD, as approved by the TWG]

Quantification Methods: [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as approved by the TWG]

Key Uncertainties

TBD – [as needed and approved by the TWG]

Additional Benefits and Costs

TBD – [as needed and approved by the TWG]

Feasibility Issues

TBD – [as needed and approved by the TWG]

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #7 or #8]

Level of Group Support

TBD – [blank until GCGW meeting #7 or #8]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

AFW-8. Advanced Recovery and Recycling

Policy Description

Increasing waste recovery and recycling and reducing waste generation limits GHG emissions associated with landfill methane generation and with the production of raw materials. Additional actions include increasing existing recycling programs, creating new recycling programs, providing incentives for recycling construction materials, developing markets for recycled materials, and increasing average participation/recovery rates for all existing recycling programs.

Policy Design

Goals: Divert X% of the municipal solid waste stream to recycled materials markets by X% by 2015 and X% by 2025.

Timing: TBD – [as approved by the TWG]

Parties Involved: TBD – [as approved by the TWG]

Other: As mentioned in Appendix G of the Draft Arkansas Inventory and Forecast, the state of Arkansas has not yet published emplacement, diversion, or characterization data for municipal solid waste (MSW). However, *BioCycle* magazine published estimates for Arkansas' 2004 MSW management performance in its 15th survey of MSW management in the United States.[4] *BioCycle* uses data from the *Waste Business Journal Directory & Atlas of Non-Hazardous Waste Sites*[5] to develop estimates for states that do not report MSW management data. According to this publication, Arkansas generated about 2.8 million tons of MSW in 2004, of which 558,000 tons were recycled, 35,000 tons were incinerated (waste-to-energy combustion), and 2.2 million tons were landfilled. Of the total waste recycled, about 112,000 tons was compostable organic material that was composted. The total waste diversion rate in 2004 was 19.7%; the recycling rate, 15.8%; and the composing rate, 3.9%. Absent additional information provided by the TWG or the Arkansas Department of Environmental Quality (AR DEQ), these MSW disposal data will be considered the baseline for the analysis of this option.

NOTE: According to information received during the Inventory and Forecast process, there are currently no waste incinerator facilities in Arkansas. This is a data question that should be resolved based on input from the TWG and AR DEQ.

Implementation Mechanisms

TBD – [as approved by the TWG]

[4] P. Simmons, N. Goldstein, S.M. Kaufman, N.J. Themelis, and J. Thompson, Jr., "The State of Garbage in America," *BioCycle* April 2006. Accessed on August 24, 2007, at: http://www.seas.columbia.edu/earth/wtert/sofos/Simmons_SOG06.pdf.

[5] See http://www.wastebusinessjournal.com/diratlas.htm.

Related Policies/Programs in Place

Recycling Goals

Act 94 (HB 1055)—The act adds a new goal to the year 2000 recycling goals for Arkansas, which is to recycle 40% of the MSW by the end of 2005 and 45% of the MSW by the end of 2010. The act also defines MSW.

Solid Waste Management and Recycling Fund

Act 1325 (SB 575)—This act permits grants from the Solid Waste Management and Recycling Fund to be used for the cost of "recycling programs." Previous law permitted grants to be used for "recycling programs and market development."

Type(s) of GHG Reductions

- **CO_2:** Reductions in Upstream Energy Use—The energy and GHG intensity of manufacturing a product are generally less when using recycled, rather than virgin, feedstocks.
- **CH_4:** Diverting biodegradable wastes from landfills decreases methane gas releases from landfills.

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: [TBD, as approved by the TWG]

Quantification Methods: [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as approved by the TWG]

Key Uncertainties

TBD – [as needed and approved by the TWG]

Additional Benefits and Costs

TBD – [as needed and approved by the TWG]

Feasibility Issues

TBD – [as needed and approved by the TWG]

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #7 or #8]

Level of Group Support

TBD – [blank until GCGW meeting #7 or #8]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

AFW-9. End-of-Use Waste Management Practices

Policy Description

These programs use the renewable energy created at landfills by anaerobic digesters (methane) to make electric power, space heat, or liquefied natural gas. New processes for converting waste energy include biomass gasification and pyrolysis. A range of renewable products can be developed from these processes, including gaseous and liquid fuels, biochar, and chemical products. Existing processes include waste combustion and energy recovery (as electricity, steam, or both).

Policy Design

TBD

Goals: Develop additional landfill gas-to-energy (LFGTE) and anaerobic digester projects to increase the number of uncontrolled MSW landfills recovering methane as an energy source, such that X% of the landfill gas being generated at uncontrolled landfill sites is controlled by 2025.

Timing: TBD – [as approved by the TWG]

Parties Involved: TBD – [as approved by the TWG]

Other: The Center for Climate Strategies has yet to identify any projects undertaking the anaerobic digestion of solid waste for the purposes of energy capture. However, three current projects capture the methane from landfills and convert it to either electricity or direct heat. The U.S. Environmental Protection Agency's Landfill Methane Outreach Program has identified six other landfills in Arkansas as being “candidate” or “potential” landfills for landfill methane-to-energy conversion.[6] Based on the baseline data from the Draft Inventory and Forecast, the 2005 GHG emissions from municipal landfills was about 1.7 million metric tons of carbon dioxide equivalent ($MMtCO_2e$). Based on the current annual GHG reductions from LFGTE projects already in place (0.37 $MMtCO_2e$), the baseline percentage (2005) of methane captured from landfills in Arkansas was about 18%.

Implementation Mechanisms

TBD – [as approved by the TWG]

Related Policies/Programs in Place

TBD – [as needed and approved by the TWG]

[6] U.S. Environmental Protection Agency, Landfill Methane Outreach Program, "Energy Projects and Candidate Landfills." Online database accessed on January 28, 2008, at: http://www.epa.gov/lmop/proj/index.htm.

Type(s) of GHG Reductions

- **CO_2:** Upstream Energy Use Reductions – The energy and GHG intensity of manufacturing a product is generally less using recycled feedstocks than from using virgin feedstocks.
- **CH_4:** Diverting biodegradable wastes from landfills will result in a decrease in methane gas releases from landfills.

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: [TBD, as approved by the TWG]

Quantification Methods: [e.g., Full life cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as approved by the TWG]

Key Uncertainties

TBD – [as needed and approved by the TWG]

Additional Benefits and Costs

TBD – [as needed and approved by the TWG]

Feasibility Issues

TBD – [as needed and approved by the TWG]

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #7 or #8]

Level of Group Support

TBD – [blank until GCGW meeting #7 or #8]

Barriers to Consensus