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Energy Supply (ES) Technical Work Group

Summary List of Pending Priority Policy Options for Analysis

Policy 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			
ES-1	Green Power Purchases and Marketing	*Transferred to RCI*					
ES-2	Technology Research & Development	*Not Quantifiable*					Pending
ES-3A	Renewable Portfolio Standard (RPS)	*Not Yet Quantified*					Pending
ES-3B	Renewable Energy Feed-In Tariff (REFIT)	*Not Yet Quantified*					Pending
ES-4	Grid-based Renewable Energy Incentives and/or Barrier Removal	*Not Yet Quantified*					Pending
ES-5	Approaches Benefiting From Regional Application	*Not Yet Quantified*					Pending
ES-6	Combined Heat and Power	*Not Yet Quantified*					Pending
ES-7	Geological Underground Sequestration for New Plants	*Not Yet Quantified*					Pending
ES-8	Transmission System Upgrades	*Not Yet Quantified*					Pending
ES-9	Nuclear Power	*Not Yet Quantified*					Pending
ES-10	Carbon Tax	*Not Yet Quantified*					Pending
ES-11	Efficiency Improvements and Repowering of Existing Plants	*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 pending priority draft policy options is for reference purposes only; it does not reflect prioritization among these important draft policy options.

ES-1. Green Power Purchases and Marketing

Policy Description

[The Energy Supply (ES) Technical Work Group (TWG) recommends that this option be removed from the ES TWG list of policy options because it overlaps completely with Residential, Commercial, and Industrial (RCI) policy RCI-7, where it is more appropriately located.]

Green power purchasing refers to a variety of consumer-driven strategies to increase the production and delivery of low-greenhouse gas GHG power sources beyond levels achieved through renewable portfolio standards and other mandatory programs. These programs provide consumers with information about alternative green sources that can be then be selected by the consumer, rather than the traditional, more carbon-intensive sources.

This policy should establish an Arkansas Green Power consortium, with participation from a variety of groups, including the electric utilities, in-state renewable energy producers, the Arkansas Department of Economic Development and state universities' technology wings. The consortium should:

- Work to develop renewable energy production facilities in the state.
- Publicize, communicate, and market this power to consumers with a voluntary Arkansas Green Power fund.
- Establish a revolving loan pool to assist in the start-up costs for the program and re-invest the dollars in new and emerging technologies involving green power.

Policy Design

Goals:

- Electric facilities purchase green power to cover [x]% of their power needs by [year].
- Implement programs to provide consumers the option to purchase green power.

Timing: Consumer purchasing participation of green power by [year].

Implementing Parties: State facilities, electric utilities, renewable energy producers, electricity consumers, and buyers of energy-using appliances and equipment.

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

Implementation Mechanisms

TBD – [as approved by the TWG]

Related Policies/Programs in Place

A 2007 survey 44% of Arkansas residential consumers would be willing to pay more for electricity produced from renewable resources. While this survey was exclusively from electric

cooperative members, the data could reasonably be expected to apply to all Arkansas consumers. Based on the data, a comprehensive marketing and communications strategy was developed, and the ECA GreenPower voluntary program was launched in March 2008. Consumers could voluntarily purchase 100 kilowatt-hour (kWh) blocks of electricity at $0.05 per kWh, or $5.00 per block. ECA will escrow 100% of the funds and use the accumulated resources to build, acquire, or otherwise provide energy produced by new renewable resources to supplement the existing hydroelectric generation (average annual hydro production exceeds 500,000 megawatt-hours [MWh]). Alternatively the funds may be used to invest in energy efficiency efforts.

Despite an aggressive marketing campaign (including print, magazine, radio, bill stuffers, internet marketing, direct mail and special event marketing), response to the program has been less than enthusiastic. However, the program is only 2 months old.

ECA's experience is consistent with that of most electric utilities that have introduced consumer-driven green power programs. One of the more successful U.S. programs, the North Carolina Green Power program. has been marketing renewables for over 2 years and has not passed the 1% participation rate.

Encouraging a higher participation level may be achieved by linking the development of renewable resources with economic development and more effective promotion.

Type(s) of GHG Reductions

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: TBD

Quantification Methods: TBD

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-2. Technology Research & Development

Policy Description

Research and Development (R&D) funding can be targeted toward a particular technology or group of technologies as part of a state initiative to build an industry around that technology in the state, and/or to set the stage for adoption of the technology for use in the state. For example, an agency can be established with a mission to help develop and deploy energy storage technologies. R&D funding can also be made available to any renewable or other advanced technology through an open bidding procedure (i.e., driven by bids received rather than by a focused strategy to develop a particular technology). Funding can also be given for demonstration projects to help commercialize technologies that have already been developed, but are not yet in widespread use. Finally, funding could be targeted to increase collaboration among existing institutions in the state for R&D.

States can undertake initiatives focused on developing, promoting, and/or implementing one or more specific fossil fuel or nuclear technologies that show promise for reducing GHG emissions. Technologies could include, among others, carbon capture and storage (to sequester carbon dioxide (CO_2) emissions from power plants, oil and gas operations, and/or refineries); biomass blending in coal power plants; implementation of equipment in oil and gas operations that increases efficiency and reduces losses (e.g., remote sensors of leaks).

Policies to encourage CO_2capture and storage or reuse (CCSR) could include a state agency or department within an existing agency tasked with promoting CCSR, evaluation studies to identify geologically sound reservoirs, R&D funding to improve CCSR technologies, and/or financial incentives or mandates to capture and store carbon or to capture and reuse it.

Policy Design

Goals:

- Identify the likely funding mechanisms and policy tools that would provide further stimulus for the development of new, reasonable cost, low- and zero-GHG-emitting electricity generation in Arkansas.
- Complete a detailed evaluation study for [specific alternative] energy potential in Arkansas.
- Complete a least one high-visibility R&D demonstration to showcase alternative energies.

Timing: Establish funding in the [year] legislative session. Study finished in [year]. First request for proposals issued [month, year].

Parties Involved: State government, private and public partners on a voluntary basis.

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

Implementation Mechanisms

Use of existing regulatory authority to address relevant issues, such as pricing, etc.

Related Policies/Programs in Place

TBD – [as needed and approved by the TWG]

Type(s) of GHG Reductions

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Not quantifiable.

Data Sources: TBD

Quantification Methods: TBD

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-3A. Renewable Portfolio Standard (RPS)

Policy Description

A renewable portfolio standard (RPS) is a requirement that utilities must supply a certain, generally fixed percentage of electricity from an eligible renewable energy source(s). An environmental portfolio standard (EPS) expands that notion to include energy efficiency or other GHG emission-reducing technologies as an eligible resource. About 20 states currently have an RPS in place. In some cases, utilities can also meet their portfolio requirements by purchasing Renewable Energy Certificates from eligible renewable energy projects. For application in Arkansas, the state's current definition of renewable energy sources should be used in defining eligible sources for an RPS.

Policy Design

Goal: Each investor-owned and public utility should be able to provide 15% of its load using renewable energy resources.

Timing: Beginning in 2015.

Parties Involved: Investor-owned utilities, electric cooperatives, state government.

Other: None cited.

Implementation Mechanisms

The Arkansas Public Service Commission will evaluate the potential cost impact on consumers.

Related Policies/Programs in Place

TBD – [as needed and approved by the TWG]

Type(s) of GHG Reductions

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Policy 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			
ES-3A	Renewable Portfolio Standard (RPS)						Pending

Data Sources:

A. Energy Consumption by Sector (billions of British thermal units [Bbtu])

Historical energy consumption in the state, by sector, is from the U.S. Department of Energy (DOE) Energy Information Administration (EIA) State Energy Data, available at http://www.eia.doe.gov/emeu/states/_seds.html. To calculate future projected energy consumption through 2030, growth factors were applied to the historical 2005 data. The growth factors are based on a combination of two parameters. One accounts for growth within the RCI sectors, with growth factors for residential based on projected population growth. Population figures are from the University of Arkansas Center for Business and Economic Research Population Projections for 1990 to 2004 (http://cber.uark.edu/default.asp?show=population), and the Time Series Extrapolations for 2005 to 2030 (http://www.aiea.ualr.edu/research/demographic/population/default.html). Growth in the commercial sector is based on nonmanufacturing employment growth projections, and industrial growth based on manufacturing employment. Employment projections were taken from the Arkansas Department of Workforce Service's long-term industry employment projections (http://www.discoverarkansas.net/?PageID=156), with estimated 2004 employment and 2014 projected employment figures for the manufacturing and nonmanufacturing sectors. The other factor is growth in electricity sales, which was calculated based on historical retail sales from 1990 to 2005, obtained from the EIA state electricity profile, in gigawatt-hours (GWh), available from Table 8 at: http://www.eia.doe.gov/cneaf/electricity/st_profiles/arkansas.html.

B. Baseline Power Station Electricity Generation (GWh) and Fuel Use (Bbtu)

Gross generation for 2005 was obtained from the EIA data base (EIA-906/920) on fuel stocks at all electric power sector generating facilities, broken down by fuel type. Data for later years were projected from the 2005 figure, based on projections of growth in generation for the Southwest Power Pool (SPP) region and the Southeastern Reliability Council (SERC) region. Arkansas was assumed to be located partly (85%) in the SERC region and partly (15%) in the SPP region. The projected regional consumption and generation data are from the EIA *Annual Energy Outlook 2007* (AEO 2007) and can be accessed by downloading the "Electric Generation & Renewable Resource" file at http://www.eia.doe.gov/oiaf/aeo/supplement/index.html. On-site use was subtracted from all generation figures. The analysis is based on *consumption-based* generation, meaning that the analysis is based on all electricity sources that deliver electricity to consumers *in state*; therefore, the generation of electricity within Arkansas that is exported is not counted.

C. Costs Associated With Electricity Generation

The costs in the United States to produce electricity using different types of technologies are from the AEO 2007, which used the EIA National Energy Modeling System. Capital costs and fixed and variable operations and maintenance costs are from Table 39 in the Electricity Market Module, available at: http://www.eia.doe.gov/oiaf/archive/aeo07/assumption/index.html. Prices for delivered fuel (in 2005$/ million (MM) Btu) are provided in the EIA Supplemental Tables to the AEO 2007 by region, with projections through 2030. (Download "Consumption & Prices by Sector & Census Division" at: http://www.eia.doe.gov/oiaf/aeo/supplement/; fuel prices by region begin with Table 11.) Transmission costs are added to the total as a constant $80/kW.

Quantification Methods:

A. Heat Rates (Btu/kWh)

Heat rates indicate how much fuel is used (Btu) to generate a given amount of electricity (kWh). They vary greatly, depending on the type of power stations and the fuel used. Heat rates are used to convert figures for electricity into figures for fuel use, so the fuel use can be converted into GHG emissions using GHG emission factors. Heat rates for 2005 for each type of generation and fuel were calculated from 2005 fuel use (in Bbtu) divided by 2005 generation (GWh). Projections for 2006 and beyond are based on annual combustion efficiency growth rates for the Mid-American Power Pool region. Combustion efficiency for a given year is calculated for each fuel type as the fuel use (in quadrillion Btu) divided by the electricity generated (in billion kWh), and the combustion efficiency growth rate applied to this value is based on the change in combustion efficiency from the previous year.

B. GHG Emissions Associated With End-Use Consumption (by Sector)

Historical CO_2 data by sector (and further broken down by fuel type) were calculated by two U.S. Environmental Protection Agency (EPA) State Greenhouse Gas Inventory Tool (SIT) software modules: the Fossil Fuel Combustion Module and—for emissions from industrial sources—the SIT module for industry. Methane (CH_4) and nitrous oxide (N_2O) emissions were calculated by the Stationary Combustion Module and—for emissions from industrial sources—the SIT module for industry.

Projected emissions through 2030 were based on the 2005 data, with growth factors compounded from year to year, as discussed above in section A of the Data Sources for energy consumption.

C. GHG Emissions Associated With Electricity Generation From Different Technologies and Fuels

The projected data for each GHG was calculated for each fuel and generation type (e.g., non-lignite coal in a steam plant) as a direct product of the projected generation data (in GWh) described above in section B. Metric tons (t) of CO_2 are calculated from generation as:

$$tCO_2 = GWh * (Btu/kWh) * (tons\ CO_2/MBtu) * (\%\ of\ that\ fuel\ in\ the\ fuel\ mix)$$

where (Btu/kWh) is the heat rate and (tCO_2/MBtu) is the CO_2 emission factor. The calculation is similarly for CH_4 and N_2O, which are then converted to CO_2 equivalents (CO_2e) using global warming potentials of 21 for CH_4 and 310 for N_2O. The emission factors used for each GHG were the same as those used in the EPA State Greenhouse Gas Inventory Tool (SIT) software modules.

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]

Transmission capacity will need to be available for the renewable sources.

Status of Group Approval

Pending – [until GCGW moves to final agreement at meeting #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-3B Renewable Energy Feed-In Tariff (REFIT)

Policy Description

Renewable Energy Feed-In Tariff (REFIT) is a policy option that provides guaranteed above-market rates for a given period to entities that install qualifying sources of renewable energy and sell energy back to the grid. The higher rate helps overcome the cost disadvantages of renewable energy sources and may be set at different levels for the various forms of renewable power generation. Utilities would be able to recover the cost of the program, plus a reasonable profit, from their rate-payer base. In cases where the entity does not have the capital available to finance the renewable energy installation, it can display this utility guarantee to a financial institute and to aid in obtaining a loan for the purchase price of the installation.

Some observers argue that Arkansas has significant amounts of such electricity-producing new renewable energy resources as wind, photovoltaic (PV), concentrating solar, biomass, or geothermal, while others argue that these resources exist only in insignificant amounts. It is partly for this reason that a mandated RPS is controversial and, for utilities, risky. By avoiding mandates, REFIT avoids these controversies and risks, while maximizing investments in renewable energy sources. This type of program was pioneered by Germany during 1990–2000, and is behind the large growth in wind power in Spain, Germany, and Denmark. These countries now get 9%, 5%, and 20% of their electricity, respectively, from wind, and are beginning to branch out into PV other solar forms of renewable electricity.

Policy Design

Goals:

- Require utilities to purchase electricity from individuals, municipal or local governments, or companies that own qualifying renewable energy facilities by means of a REFIT. The REFIT will stipulate government-set, above-market electricity rates and for a guaranteed 20-year period, for renewable electricity from approved sources. The rates should be high enough to provide an incentive for individuals or companies to install renewable energy systems.
- Establish a program that will encourage financing for such individuals or companies to install approved renewable electricity sources, and to allow utilities to recover the cost of this program (plus a reasonable profit) from their ratepayer base.
- Approved forms of renewable energy should include at least wind and solar, where "solar" should include at least photovoltaics and solar-thermal (often called "concentrating solar"). The above-market guaranteed rate is expected to be different for different forms of renewable energy.

The REFIT can be controlled by putting a limit on ratepayer impact, whereby an increase of 5% or less in rates is dedicated to the program.

Timing: Such a program should not take long to establish and could be in operation by perhaps 2010. It is difficult to say how many individuals or firms will want to take advantage of this incentive program, so it is difficult to predict the amount of electricity that might be generated

renewably. A reasonable goal (which is not to be construed as a mandate) might be 200 megawatts (MW) by 2015, with at least 20 MW going to wind and 20 MW going to solar. The program might be expected to start small and to grow, depending on how viable wind and solar and other renewable forms of electricity turn out to be in Arkansas.

Parties Involved: Investor-owned utilities, electric cooperatives, state government.

Other: None cited.

Implementation Mechanisms

Suppose that an entity (who could be an individual or a company), wants to install PV and hopes to generate enough electricity to feed back into the grid. If PV is one of the approved energy sources under the REFIT program, the regional electric utility would be required to purchase the entity's electricity at above-market rates set by the government, and to guarantee this rate for, say, 20 years (the guarantee period in Spain and Germany). The high rate helps overcome the cost disadvantages of renewable energy sources, and may differ among various forms of renewable power generation. In case the entity does not have the capital available to finance the PV installation, it can display this utility guarantee to a financial institute and receive a loan for the purchase price of the installation. (REFIT legislation must guarantee financing for qualified individuals or companies.) The cost to the utility of the above-market electricity rate is borne by ratepayers. For example, if $100,000 worth of renewable electricity is bought in a year by a utility that has 1,000,000 customers, each of those customers will have 10¢ added to their bill annually. To summarize: the entity gets an electricity-purchase incentive from the utility to produce renewable electricity and feed it into the grid, and the utility is reimbursed by ratepayers.

Since Germany, Spain, and Denmark already have considerable experience with REFIT programs, such a program should not take long to establish and could be in operation by perhaps 2012. Because it is difficult to predict how many individuals or firms will want to take advantage of this incentive program, the amount of electricity that might be generated renewably is difficult to predict. The program might be expected to start small and to grow, depending on how viable wind and solar and other renewable forms of electricity turn out to be in Arkansas.

[Will need to define a "reasonable" profit; will need to set a ceiling on recovery rates.]

Related Policies/Programs in Place

TBD – [as needed and approved by the TWG]

Type(s) of GHG Reductions

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Policy 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			
ES-3B	REFIT						

Data Sources: See ES-3A.

Quantification Methods: See ES-3A.

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-4. Grid-based Renewable Energy Incentives and/or Barrier Removal

Policy Description

Arkansas should enact tax incentives and innovative financing programs for residential and commercial utility users who develop or apply successful renewable energy systems. The tax and loan incentives should be proportional to the amount of renewable energy they are using, with the greatest incentives for those who use net metering and return energy to the grid for use by other utility customers. Legislative Council, the Arkansas Department of Finance and Revenue, the Arkansas Development Finance Authority, the Department of Environmental Quality, and the Arkansas Science and Technology Authority, in coordination with the Governor's Commission on Global Warming (GCGW) and the appropriate legislative leaders, should research model programs in other states and countries and make recommendations on specific policies in time for the next legislative session. In addition, pilot and demonstration programs should be established to demonstrate the effectiveness of these policies as they are implemented. Alternative sources of funding, including foundations, utility companies, and others, should be sought to supplement state revenue for these policies.

This policy option reflects financial incentives to encourage investment in renewable energy resources. Examples include: (1) direct subsidies for purchasing/selling renewable technologies, (2) tax credits or exemptions for purchasing renewable technologies, (3) tax credits for each kWh generated from a qualifying renewable facility, (4) and regulatory policies that provide incentives and/or assurance of cost recovery for utilities that invest in central station renewable energy systems. In addition, this option would make it a priority for the legislature, the Public Service Commission, and other relevant state agencies to identify and rectify barriers to the development of renewable resources in the state.

Policy Design

Goals: The initial evaluation should include several different types of financial incentives to represent the range of opportunities.

- Offer tax credits or other incentives of $1,500 per kW-equivalent for small solar PV, micro-hydro, and small wind.
- Provide a subsidy to renewable energy generators of $0.01/kWh for electricity generated from a renewable resource, unless that electricity is used to meet a federal, state, or voluntary renewable energy standard.
- Offer low-interest loans for feasible and desirable biomass generation that meets exemplary environmental performance standards, with partial loan forgiveness for equipment that fails to perform to standard.

Timing: Tax credits beginning in 2010 and subsidies beginning in 2015.

Parties Involved: All power producers operating qualifying facilities for incentives other than tax credits, which would be available to any grid-connected customer.

Other:?

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

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Policy 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			
ES-4	Grid-based Renewable Energy Incentives and/or Barrier Removal	*Not Yet Quantified*					Pending

Data Sources: See ES-3A.

Quantification Methods: See ES-3A.

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-5. Approaches Benefiting From Regional Application

Policy Description

The primary goal of this policy option is to establish a program that will allow Arkansas to adapt to and be prepared for a federally implemented cap-and -trade system. A cap-and-trade system is a market mechanism by which GHG emissions are limited or capped at a specified level, and those participating in the system are required to hold permits for each unit of emissions. Through trading, participants with lower costs of compliance can choose to overcomply and sell their additional reductions to participants for whom compliance costs are higher. In this fashion, overall costs of compliance are lower than they would otherwise be.

Policy Design

Goals: Not quantifiable.

Timing: Beginning in [year]

Parties Involved: Target entities.

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

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

TBD – [as approved by the TWG]

Data Sources: See ES-3A.

Quantification Methods: See ES-3A.

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-6. Combined Heat and Power

Policy Description

Combined heat and power (CHP) refers to any system that simultaneously or sequentially generates electric energy and utilizes the thermal energy that is normally wasted. The recovered thermal energy can be used for industrial process steam, space heating, hot water, air conditioning, water cooling, product drying, or nearly any other thermal energy need in the commercial and industrial sectors. The end result is significantly increased efficiency over generating electric and thermal energy separately. In fact, many CHP systems are capable of an overall efficiency of over 80%—double that of conventional systems. Another significant advantage is the reduced transmission and distribution (T&D) losses associated with centralized power generation.

Policy Design

Reports from EIA show 16 distributed generation (DG) units in Arkansas with a capacity of 1–20 MW with combined a capacity of 126 MW. Annual energy production from these facilities exceeds 785 GWh, equivalent to less than 2% of retail energy sales. Though no assessment of the thermal efficiency is available, the units operate at a relatively high capacity factor, exceeding 70%. According to an assessment by the Electric Power Research Institute, the market adoption of CHP has been limited due to a confluence of barriers, including a lack of compelling savings and economics for end users and a lack of high enough margins for utility or third-party business models.

The combination of higher natural gas prices, potential increased cost of all fuel-based energy production due to CO_2 restrictions, impediments to expanding use of coal-based generation, escalating cost for T&D facilities, and dramatic increases in the capital cost for all bulk power supply options will enhance the savings and economics for CHP.

The state should expand on EIA survey data to determine the number of existing DG projects that have CHP potential, assessing the energy reductions achievable with forecasted escalating energy costs.

Goals: Reduce use of fossil fuel from large industrial sources through a 10% efficiency improvement. This will most likely result in reduced use of natural gas.

Timing: Efficiency improvements begin in 2011 and ramp up linearly with full achievement by 2020.

Parties Involved: State government and regulators, electric utilities, and renewable energy and CHP industry.

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

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Policy 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			
ES-6	Combined Heat and Power	*Not Yet Quantified*					Pending

Data Sources: See ES-3A.

Quantification Methods: See ES-3A.

Key Assumptions:

A) The program begins in 2011 and continues annually.

B) It is assumed that 90% of the reduction in electricity usage will come from natural gas and 10% from coal.

C) Given that 38.3% of total electricity usage in Arkansas is in the industrial sector the analysis assumes that 35% of total usage is by large industrial sources. Therefore the total electricity reduction goal is 3%.

D) Program ramps up linearly until 2021.

E) Escalation rate for gross generation & associated CO2e emissions beyond 2025: .51%

F) Annual rate at which costs are discounted: 5%

G) Net present value calculated in 2008 dollars.

H) Efficiency stays constant after 2020

I) CHP is twice as efficient as current generation (half GWh replaced, half GWh avoided heat charges.

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-7. Geological Underground Sequestration for New Plants

Policy Description

This policy refers to the capture of CO_2 from fossil fuel-fired power plant emissions and its sequestration in geologic formations, including oil and gas reservoirs, unminable coal seams, and deep saline reservoirs. Broadly, three different types of technologies exist: post-combustion, pre-combustion, and oxyfuel combustion. After capture, the CO_2 must be transported to suitable storage sites; this is often done by pipeline.

As soon after its opening date as the technology becomes available, the Plum Point Plant should install and employ post-combustion carbon capture and storage (CCS). The Hempstead Plant should not open until it employs, at that time in the future (estimated at 2013–2018) when the technology becomes available, state-of-the-art pre-combustion CCS equipment. All other new coal-fired generating plants should employ state-of-the-art pre-combustion CCS equipment.

Policy Design

Goals: Capture 80%–90% of CO_2 emissions from new power plants

Timing: Reductions achieved beginning in 2018

Parties Involved: [large, new, coal-fired power plants]

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

Implementation Mechanisms

TBD – [as approved by the TWG]

Related Policies/Programs in Place

One new coal-fired plant, the Plum Point Plant, is under construction in Arkansas, near Osceola. A second new plant, the Hempstead plant near Texarkana, has been approved by the Arkansas Public Service Commission (APSC) but has not yet received its permit from the Arkansas Department of Environmental Quality. Note that the APSC requires cost-effective sequestration technologies when available.

If opened as presently planned, each plant will, emit about 5 $MMtCO_2$/year. Together, they will add about 16% to Arkansas emissions (62 $MMtCO_2$ in 2004).

The large GHG emissions from coal-fired generating plants caused APSC Commissioner David Newbern to dissent from the other two Commissioners' approval of the Hempstead Plant, and to ask "that coal be rejected as the fuel to be used in the construction of any new generating plant unless and until the technology exists, and will be used, to capture and sequester all of the CO_2 emissions" (the quotation is from Newbern's APSC opinion). It is also the stimulus behind a recent bill in the U.S. Congress to place a moratorium on new coal plants until sequestration of the CO_2 emissions from new plants is achieved, and the reason many climate experts, such as the

National Aeronautics and Space Administration's chief climate scientist, James Hansen, along with 48 fellow authors of a recent scientific paper on global warming, recommend a similar moratorium on new coal plants.

The charge of the Arkansas GCGW is "to establish a global warming pollutant reduction goal and comprehensive strategic plan." It is difficult to see how the GCGW can meet this charge if the Plum Point Plant and the Hempstead Plant open as planned.

Type(s) of GHG Reductions

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Policy 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			
ES-7	Geological Underground Sequestration for New Plants	*Not Yet Quantified*					Pending

Data Sources: See ES-3A.

Quantification Methods: See ES-3A.

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-8. Transmission System Upgrades

Policy Description

Measures to improve transmission systems to reduce bottlenecks and enhance throughput may be required to satisfy long-term electricity demands, improve the efficiency of operations, and allow for delivery of diverse and renewable energy sources located outside of the state. Opportunities may exist to substantially increase transmission line carrying capacity through the implementation of new construction and retrofit activities on the transmission grid, including incorporating advanced composite conductor technologies, capacitance technologies, and grid management software. Siting new transmission lines can be a difficult process, given their cost and their local impact on the environment and on the use, enjoyment, and value of property.

Policy Design

A primary goal of this policy option can be to provide incentives to utilities to upgrade existing transmission systems and reduce barriers to siting of new transmission lines to provide access to new energy sources often far from existing transmission lines and load centers.

Another goal of this policy can be to reduce T&D line losses. Utilities use a variety of components throughout the T&D system to manage losses. Increasing the efficiency of these components can further reduce losses and associated GHG emissions. For example, the state of Vermont offers a rebate to encourage the installation of energy-efficient transformers. Regulations, incentives, and/or support programs can be applied to achieve greater efficiency of T&D system components.

A third goal can be the general distribution of generation support (interconnection rules, net metering, etc.). Well-designed interconnection rules will ensure that distributed power products meet minimum requirements for performance, safety, and maintenance, at the same time significantly advancing the commercialization of these technologies.

Goals:

- Achieve 5% effective improvement in energy efficiency through reduced T&D system losses (i.e., losses reduced from 6.5% to 6.2%).
- Achieve 5% increase in renewable energy sources through improved transmission access to these sources.

Timing: Phased in, beginning in 2013, with the established goal achieved by 2018.

Parties Involved: APSC, investor-owned utilities, generation and transmission electric cooperatives, municipalities, representatives of environmental and economic development organizations, the Federal Energy Regulatory Commission, and transmission owners and operators.

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

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Policy 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			
ES-8	Transmission System Upgrades	*Not Yet Quantified*					Pending

Data Sources: See ES-3A.

Quantification Methods: See ES-3A.

Key Assumptions:

A) The program begins in 2013 and continues through 2018

B) It is assumed that 90% of reductions in electricity production will come from coal and 10% from natural gas.

C) Effective improvements in energy efficiency through reduced T&D line losses occur at a rate of .5% in 2013 and 2014. The rate increases to 1% per year between 2015 and 2018.

D) The expected annual cost of line upgrades is $30 million

E) Escalation rate for gross generation and associated CO_2-equivalent emissions beyond 2025: .051%

F) The rate at which costs are discounted annually: 5%

G) Net present value is calculated in 2008 dollars.

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-9. Nuclear Power

Policy Description

Nuclear power has historically been a low-GHG source of electric power. However, no new nuclear power plants have come on line in the United States since 1996 due to high capital costs. Long-term disposal of nuclear waste and public safety are public policy concerns with nuclear power. With the national pricing of the GHG cost of fossil fuel generation, with either cap-and-trade system or carbon tax, nuclear power will be more cost-competitive. The Energy Policy Act of 2005 included provisions encouraging the construction of new nuclear units. There are currently nine applications for a new plant on file with the Nuclear Regulatory Commission (NRC). The one nearest to Arkansas is adjacent to the existing Grand Gulf unit in Port Gibson, MS; it has been accepted for docketing by the NRC. As new nuclear power plants come on line in the future in the Arkansas region, they will offer Arkansas electric utilities an alternative to the construction of fossil fuel generation units.

Nuclear plant relicensing allows an existing plant to extend the life of the facility for 20 years past its original 40-year license terms. The two existing nuclear units in Arkansas have already completed this process. Thus, no further reductions in current GHG emissions can achieved through the relicensing process.

Policy Design

Given the uncertainty of when new nuclear generating capacity will be on line in this region, the GCGW does not recommend a reduction goal achievable with this action. However, the GCGW does go on record supporting the construction of new nuclear power plants.

Goal: One new 1,500-MW nuclear plant operating at 95% capacity factor.

Timing: Operational in 2020.

Parties Involved: APSC.

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

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Policy 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			
ES-9	Nuclear Power	*Not Yet Quantified*					Pending

Data Sources: See ES-3A.

Quantification Methods: See ES-3A.

Key Assumptions:

A) The new nuclear plant is 95% operational by 2020.

B) New nuclear capacity is assumed to be 1500 MW

C) The cost of nuclear power in 2020 is assumed to be 39.02 ($/MWh)

D) Nuclear power replaces coal.

E) Annual rate at which costs are discounted: 5%

F) Net present value is calculated in 2008 dollars

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-10. Carbon Tax

Policy Description

A GHG tax is a tax on each ton of CO_2e emitted from certain sources. The tax could be imposed upstream and based, for example, on the carbon content of fuels (e.g., fossil fuel suppliers) or at the point of combustion and emission. Although taxed entities would pass some or all of the cost on to consumers, there would be competitive pressure to find cost-effective ways to lower (or offset) emissions. Consumers who see the implicit cost of GHG emissions in products and services could adjust their behavior to lower emissions and reduce cost. The program can be designed to be "revenue neutral" (not a net tax increase), for example, by offsetting with an income tax reduction; can fund policies and programs to assist with reducing GHG emissions; or can be directed to helping the competitiveness of industries or assisting communities affected by the tax.

Policy Design

- Set percentage limits for passing the rate cost on to customers, with the idea of opening up new renewable energy purchasing options to rate payers.
- Possibly consider a utility cap based on a regional system average rate, much like what's needed with the oil industry. The intent would be to put the pressure back on the business sector to adjust to the market instead of consumers' having no options. This would cross over with other sections of the GCGW's effort to give rate payers renewable options.
- A carbon tax would give an immediate option for funding the Arkansas Climate Change Institute and the programs and costs that come out of the GCGW's recommendations.

Goals:

- Integrate a carbon tax program in correlation with a regional cap-and-trade system.
- Work with surrounding states to establish a market base value and standard that include Arkansas-specific opportunities based on economic and environmental benefits.
- Integrate a low-income credit initiative that focuses on efficiency.
- Establish a program that prepares Arkansas for federal standards and puts the state ahead of the game (instead of playing catch-up) and in a position that benefits rate payers most in need (i.e., low-income customers).
- Establish a program that will easily allow Arkansas to adapt to a federal cap-and-trade system.
- After coordinating with a regional system, establish a recording/banking system that will put the South at an advantage—from financial, environmental, and adaptability perspectives—of being prepared for federal standards for a cap-and-trade program.

Timing: Beginning in 2009 and system in place by late 2009.

Parties Involved: All entities included in all other Arkansas climate change processes.

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

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Policy 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			
ES-10	Carbon Tax	*Not Yet Quantified*					Pending

Data Sources: See ES-3A.

Quantification Methods: See ES-3A.

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]

ES-11. Efficiency Improvements and Repowering of Existing Plants

Policy Description

Efficiency improvements at existing plants refers to increasing generation efficiency through improvements such as more efficient boilers and turbines, improved control systems, or combined cycle technology. This could also include switching to lower or zero emitting fuels at existing plants, or new capacity additions. Policies to encourage efficiency improvements and repowering of existing plants could include incentives and/or regulations. Most economic improvements have already been made, however, existing power plants should be encouraged to reach specific energy efficiency goals before new plants are constructed.

Policy Design

Goals: Beginning in 2010, power plants should commence efficiency measures by improvement in heat rates from existing levels, the policy will include a linear ramp up schedule until a maximum 10% efficiency obtainable is reached by 2020.

Timing: 5% improvement achieved by 2015; 10% achieved by 2020.

Parties Involved: Public/consumers, state and local government, APSC.

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

Implementation Mechanisms

An estimated cost of carbon should be included to help drive further improvements in efficiency.

Related Policies/Programs in Place

TBD – [as needed and approved by the TWG]

Type(s) of GHG Reductions

TBD – [as approved by the TWG]

Estimated GHG Reductions and Costs or Cost Savings

Policy 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			
ES-11	Efficiency Improvements and Repowering of Existing Plants	*Not Yet Quantified*					Pending

Data Sources: See ES-3A.

Quantification Methods: See ES-3A.

Key Assumptions:

A) Program begins in 2010

B) Efficiency of power plants improves at a rate of 1% per year until 2020.

C) No improvement after 2020.

D) Power plants targeted for heat rate improvements are those fired by coal and natural gas.

E) It is assumed that it will cost $10 million per year to improve heat rates.

F) Escalation rate for gross generation and associated CO2e emissions beyond 2025: .51%

G) The rate at which future costs are discounted is 5%

H) Net present value is calculated in 2009 dollars

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 #8, #9, or #10]

Level of Group Support

TBD – [blank until GCGW meeting #8, #9, or #10]

Barriers to Consensus

TBD – [blank until final vote by the GCGW]