Draft Catalog of State Actions
Energy Supply (ES) Technical Work Group (TWG)

Results of Notional Rating Exercise

A catalog of state-level, greenhouse gas (GHG)-reducing actions and policy options prepared by the Center for Climate Strategies (CCS), Kansas Energy and Environmental Policy Advisory Group (KEEP), and others based on actions undertaken or considered by Kansas and other states, including regional, state, local, and private actions.

Important Note: The state actions are numbered in this catalog solely for convenience in referencing them. Their numbers do NOT reflect a ranking or prioritization of the actions.

Key to Notional Rankings of Options in the Tables That Follow

Potential GHG Emission Reductions*	Potential Cost or Cost Savings*,†
High (H): At least 1.0 million metric tons of carbon dioxide equivalent ($MMtCO_2e$) per year by 2020	**High (H)**: $50 per metric ton of CO_2e (tCO_2e) or above
Medium (M): From 0.1 to 1.0 $MMtCO_2e$ per year by 2020	**Medium (M):** \$5–\$50/tCO_2e
Low (L): Less than 0.1 $MMtCO_2e$ per year by 2020, or 1.0 $MMtCO_2e$ by 2050	**Low (L):** Less than \$5/tCO_2e
Uncertain (U): Not able to estimate at this time	**Uncertain (U):** Not able to estimate at this time
	Negative (N): Net cost savings

*Several measures may overlap in terms of emission reductions and/or cost impacts. Estimates assume measures would be implemented independently from other measures.
† Costs are denoted by a positive number. Cost savings (i.e., "negative costs") are denoted by a negative number.

Option No.	GHG Reduction Policy Option	Potential GHG Emission Reductions	Cost per Ton	Externalities, Feasibility Considerations	Notes/Related Actions in Kansas
ES-1	**EMISSIONS POLICIES AND OVERARCHING ITEMS**				
1.0	Overarching Items	**H:** 1 **M:** 1 **L:** 2 **U:** 2	**H:** 0 **M:** 1 **L:** 3 **N:** 0 **U:** 2		• Kansas is a member of the Midwestern Greenhouse Gas (GHG) Reduction Accord. • Kansas is an observer of the Western Climate Initiative. • Kansas Administrative Order 08-03 establishes KEEP.
1.1	GHG Cap and Trade	**H:** 4 **M:** 3 **L:** 2 **U:** 2	**H:** 4 **M:** 5 **L:** 1 **N:** 0 **U:** 1	• Higher electricity prices, reduced economic activity, high utilization of natural gas. All sectors?	• Kansas is a member of the Midwestern GHG Reduction Accord, which is exploring regional cap-and-trade policies. • Kansas is an observer of the Western Climate Initiative, which is exploring cap-and-trade policies.
1.2	Carbon/GHG Tax	**H:** 5 **M:** 1 **L:** 1 **U:** 3	**H:** 6 **M:** 2 **L:** 1 **N:** 0 **U:** 1	• Higher electricity prices, reduced economic activity, high utilization of natural gas. All sectors? • Impact on low-income ratepayers	
1.3	Generation Performance Standards and/or Mitigation Requirements for Electricity	**H:** 4 **M:** 3 **L:** 1 **U:** 2	**H:** 4 **M:** 4 **L:** 0 **N:** 0 **U:** 2	• How to identify the performance standards?	

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1.4	Integrated Resource Planning (IRP)	**H:** 1 **M:** 2 **L:** 6 **U:** 1	**H:** 1 **M:** 3 **L:** 5 **N:** 0 **U:** 1	• Duplicates existing requirements or practices already in place	• Sunflower Electric and Kansas Electric Power Cooperative (KEPCo) are required to submit integrated resource plans (IRPs) to federal agencies (i.e., Western Area Power Administration [WAPA]) as a requirement of participating in hydropower preference allocations.
1.5	Voluntary GHG Reduction Commitments	**H:** 1 **M:** 1 **L:** 6 **U:** 1	**H:** 1 **M:** 2 **L:** 5 **N:** 0 **U:** 1	• Imposes additional costs on our customers and disadvantages them economically compared to customers of other companies. How do corporation commissions evaluate the inclusion of these costs in rate structures? How do you decide the platinum level, gold level and silver level of voluntary efforts? Voluntary is different from cost effective or R&D • Clarity of scope	• Kansas is a member of the Midwestern GHG Reduction Accord. • Kansas Executive Order 08-03 established KEEP to develop recommendations for a climate action plan. • In February 2008, Westar, Inc., and the Kansas Department of Health and Environment (KDHE) signed an agreement to voluntarily reduce GHG emissions, including carbon dioxide (CO_2). Under the agreement, Westar will perform a companywide inventory of its GHG emissions. It will also conduct a comprehensive evaluation of net GHG reduction measures, including carbon capture and sequestration, as well as EE programs. Upon approval from KDHE and potential regulatory approval for cost recovery, Westar will implement the reduction measures at each of its applicable generating units. • In March 2007, Kansas City Power & Light (KCP&L), the Sierra Club, and the Concerned Citizens of Platte County

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					(CCPC) agreed on a set of initiatives to offset CO_2 emissions, particularly with respect to KCP&L's proposed new coal-fired powerplant in Missouri. KCP&L agreed to pursue offsets for GHGs associated with its new plant through significant investments in EE and renewable energy. The agreement allows for carbon offsets throughout KCP&L's system, which may include CO_2 reductions at the La Cygne power plant in Kansas.
1.6	Technology Research and Development	**H:** 7 **M:** 1 **L:** 1 **U:** 1	**H:** 7 **M:** 1 **L:** 1 **N:** 0 **U:** 1	• It will be expensive to identify reduction technologies and it is doubtful that one strategy will work everywhere • No good deed goes unpunished	
ES-2	**RENEWABLE ENERGY**				
2.1	Renewable Portfolio Standard (RPS)	**H:** 6 **M:** 4 **L:** 2 **U:** 0	**H:** 5 **M:** 5 **L:** 2 **N:** 0 **U:** 0	• Using more wind will require a pairing with natural gas which has been expensive. You must have both wind and gas, so consumers absorb the cost of two generating units. • Include cost of backup	• Voluntary RPS to meet 10% of Kansas energy demand with wind power by 2010 and 20% by 2020. See KSA 2007 Supp. 66-1,184(g). • Since December 2006, nearly 1,000 megawatts (MW) of potential new wind power was announced by a number of the state's leading utilities. The new Smoky Hill Wind Project, along I-70 in Lincoln and Ellsworth Counties, was

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				energy for wind (as a surrogate for "renewable energy"). • Define RPS standard to evaluate potential GHG emissions. • Vastly more effective if national, in which case DOE says KS could provide 7,000 MW or more, avoiding many millions of tons of CO2 emissions when replacing coal, and even when displacing natural gas. 20% RPS for KS should be energy based, not capacity based. Since utilities will not grant wind capacity, they should not claim nameplate capacity, but rather energy generated. • Already occurring and should be encouraged. There is a direct link to incentives on a Federal and state level. Siting restrictions hamper. Key for	developed by TradeWind Energy, LLC, a Kansas developer, and will be owned by Enel North America, Inc. It features 100 MW of wind generation to be divided among Sunflower Electric, Kansas City Board of Public Utilities, and Midwest Energy. • The state's largest utility, Topeka-based Westar, announced on February 26, 2007, a request for proposals (RFP) for 500 MW of renewable energy. This was followed by a joint announcement on March 20 by KCP&L and the Sierra Club of a commitment of another 400 MW of wind generation. Westar plans to have about 300 MW of the development installed by the end of 2008. KCP&L already owns the Spearville Wind Energy Facility in Ford County that was put into operation in Fall 2006. • These announcements will ensure Kansas utilities will meet a voluntary goal of 1,050 MW of wind by 2010, as announced by Governor Sebelius during the State of the State address in January 2007. This equals about 10% of nameplate electric generation capacity for the state's utilities. The utilities agreed to a commitment of a 20% voluntary goal by 2020.

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				continuance is permitting of load matching CTs and permitting of adequate transmission facilities.	
2.2	Grid-Based Renewable Energy Regulations, Incentives and/or Barrier Removal	**H:** 2 **M:** 3 **L:** 3 **U:** 2	**H:** 0 **M:** 6 **L:** 2 **N:** 0 **U:** 2	• The production tax credit and other credits have provided good incentive for investment. Not sure additional incentives are needed. • Risk analysis should accompany any recommended changes in regional reliability requirements.	• Executive Order 08-01 establishes the Governor's Kansas Wind Working Group (WWG), which will educate stakeholder groups with current information on wind energy markets, technologies, economics, policies, prospects, and issues. The WWG will be supported by the Energy Programs Division of the KCC, the lieutenant governor's office, and Wind Powering America (WPA). WPA is collaborating with state partners and their stakeholders through its WWG network, now operating in some 30 states. WPA will provide technical assistance, objective analysis, up-to-date information and education, and seed funding for the Kansas WWG. • KSA 2007 Supp. 79-32,245 – 32,249 provides income tax credits for investment in new renewable cogeneration facilities and KSA 2007 Supp. 79-32,251 – 32,255 provide income tax incentives for certain biofuel storage and blending equipment.

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2.3	Distributed Renewable Energy Incentives and/or Barrier Removal	**H:** 1 **M:** 4 **L:** 6 **U:** 0	**H:** 5 **M:** 4 **L:** 2 **N:** 0 **U:** 0	• Kansas has good incentives for distributed generation in place now. Incentives in other states can be examined to determine how their experience varies from Kansas. • Distributed generation will be important in the long term, but costly in the short-term. Likely a second-tier investment	• Kansas has a property tax exemption for property with renewable energy equipment. • KSA 2007 Supp. 79-32,245 – 32,249 provides income tax credits for investment in new renewable cogeneration facilities and KSA 2007 Supp. 79-32,251 – 32,255 provide income tax incentives for certain biofuel storage and blending equipment. • The Renewable Energy Electric Generation Cooperative Act provides for creation of a cooperative by five or more people. Members of these cooperatives must operate generation facilities that use renewable resources and must have a capacity of at least 100 kilowatts (kW) of electricity.
2.4	Green Power Purchases and Marketing	**H:** 1 **M:** 7 **L:** 3 **U:** 0	**H:** 1 **M:** 7 **L:** 2 **N:** 0 **U:** 1	• The right program run on a state or national level could be another incentive to add to 2.2 and 2.3. • Green power pricing encourages utilities to do more, faster; is voluntary; subsidizes fuel switching. Cheap, effective, high palatable option.	• Green power purchases were offered by Westar in 1999, but discontinued due to low participation. A new green power purchase program is in development at Westar.

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2.5	Pricing Strategies to Promote Renewable Energy (e.g., Net Metering)	**H:** 1 **M:** 3 **L:** 6 **U:** 1	**H:** 4 **M:** 4 **L:** 1 **N:** 0 **U:** 2	• Net metering not substantially better than incentives in place today but has become symbolic. Benefits to renewable energy (from GFG perspective) are national and cost of strategy is paid locally.	
2.6	Remove Barriers to Development of Renewable Energy (Zoning, Siting, etc.)	**H:** 1 **M:** 4 **L:** 3 **U:** 3	**H:** 1 **M:** 2 **L:** 5 **N:** 0 **U:** 3	• This will likely always be a local issue. • Local debates about new facilities will occur. Removing barriers sounds a bit akin to repealing the Clean Air Act. • The siting act exempts ALL facilities (except nuclear) not just renewable • Already occurring and should be encouraged. There is a direct link to incentives on a Federal and state level. Siting restrictions hamper. Key for continuance is permitting of load matching CTs and	• The Kansas Energy Council (KEC) developed the *Wind Energy Siting Handbook* in 2005, with suggestions for developing local guidelines. • The Electric Generation Facility Siting Act Amendments of 2000 exempt all renewable generation facilities, except nuclear, from siting requirements. • Siting of wind resources has been controversial in some situations in Kansas; for example, the executive order placing a moratorium in the Flint Hills raised objections in the Ellis County and Ellsworth County areas.

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				permitting of adequate transmission facilities.	
2.7	Technology-Focused Initiatives (Biomass Co-Firing, Energy Storage for Renewable Energy Generation, Fuel Cells, etc.), Including Grant Programs	**H:** 4 **M:** 6 **L:** 2 **U:** 1	**H:** 6 **M:** 2 **L:** 3 **N:** 0 **U:** 1	• Research needed to determine what is feasible and cost effective. • Depends on the technology: biomass co-firing – low GHG reduction, transportation costs and high and utilization tends to be local; energy storage is a net user of energy – it doesn't produce, merely shifts the time of use; fuel cells – technology not mature and H2 transfer systems not developed; algae – high GHG emission reduction potential, technology not mature, no transfer system needed • Need to consider other wastes such as biomass, ash, wood wastes, used oil, etc. Estimates for existing	• The 2007 Kansas Renewable Energy & Energy Efficiency Conference, held September 25–26, had over 500 attendees. Multiple concurrent sessions on various energy topics were facilitated by over 40 energy experts from Kansas and throughout the country. Topics included efficiency and conservation, new technologies, wind and solar energy, biofuels, public education and loan programs, and federal policy updates. Another Renewable Energy Conference will be held in September 2008. • KSA 2007 Supp. 79-32,233 - 32,237 provides tax incentives for biomass-to-energy plants • Some Kansas university research centers are focusing on these issues.

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				facilities using co-firing.	
2.8	Research and Development for Renewable Technologies	**H:** 4 **M:** 3 **L:** 2 **U:** 1	**H:** 3 **M:** 3 **L:** 3 **N:** 0 **U:** 1	• Varies, and lacks definition to guide thinking.	• Some Kansas university research centers are focusing on these issues.
2.9	Explore Opportunities for Utility-Scale Solar Thermal Technologies	**H:** 1 **M:** 5 **L:** 3 **U:** 2	**H:** 3 **M:** 4 **L:** 2 **N:** 0 **U:** 2	• Technology not mature – backup resources needed. • Central unit PPAs being signed at less than 20 cents/KWh	
ES-3	**ENERGY EFFICIENCY**				
3.1	Energy Efficiency Resource Portfolio Standard	**H:** 4 **M:** 2 **L:** 4 **U:** 1	**H:** 4 **M:** 2 **L:** 3 **N:** 1 **U:** 1	• Cost of overall reductions though EE should be weighed against the achievable reduction in usage before a mandate of this type is proposed. • Determine a few technologies for calculation	

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3.2	Utility Energy Efficiency Incentives or Other Barrier Removal	**H:** 3 **M:** 3 **L:** 3 **U:** 2	**H:** 2 **M:** 3 **L:** 4 **N:** 0 **U:** 2	• While incentives or the removal of barriers would likely achieve more investment in EE, the cost to the ratepayer should clearly justify it. • How can this be different than 3.1?	• HB 2632 (2008) included language that would allow utilities to capitalize and earn a return on EE investments in order to put such investments on a par with traditional supply investments. • KCC is currently considering two dockets, which it will hear discussion on in August 2008. ○ Docket No. 08-GIMX-442-GIV considers what benefit-cost tests should be applied to potential EE programs ○ Docket No. 08-GIMX-441-GIV considers cost recovery, incentives, and margin recovery associated with EE programs, both demand-side management and demand response (DR).
3.3	Consumer Energy Efficiency Incentives or Other Barrier Removal	**H:** 4 **M:** 2 **L:** 3 **U:** 2	**H:** 1 **M:** 2 **L:** 5 **N:** 1 **U:** 2	• How can this be different from 3.1?	

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3.4	Combined Heat and Power (CHP) Incentives and/or Barrier Removal	**H:** 3 **M:** 4 **L:** 2 **U:** 2	**H:** 0 **M:** 5 **L:** 4 **N:** 0 **U:** 2		• KSA 2007 Supp. 79-231 provides a property tax exemption for certain waste heat utilization systems. KSA 2007 Supp. 79-32,250 provides for additional tax incentives for these systems and KSA 2007 Supp. 74-8949d authorizes the issuance of revenue bonds for their construction and installation. • The Renewable Energy Electric Generation Cooperative Act provides for creation of a cooperative by five or more people. Members of these cooperatives must operate generation facilities that use renewable resources and must have a capacity of at least 100 kilowatts of electricity.
3.5	Public Benefits Charge	**H:** 1 **M:** 2 **L:** 3 **U:** 4	**H:** 0 **M:** 4 **L:** 1 **N:** 0 **U:** 5	• Depends on the program. • How can this be different from 3.1? • Impact on low-income ratepayers	
3.6	Co-Location or Integration of Energy-Producing Facilities	**H:** 3 **M:** 4 **L:** 3 **U:** 0	**H:** 0 **M:** 2 **L:** 5 **N:** 2 **U:** 1		• The integration proposed by Sunflower Electric at the Holcomb facility is an example of efforts to encourage the more efficient utilization of heat and energy by encouraging the co-location of those facilities.

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3.7	Use Compressed Air Energy Storage Systems	**H:** 1 **M:** 4 **L:** 4 **U:** 2	**H:** 4 **M:** 2 **L:** 2 **N:** 0 **U:** 3	• Energy storage systems USE electricity • Enabling win to meet base load through energy storage is promising but not yet proven at scale. Substantial upfront capital costs make this a high cost option with high long-term value if it can be achieved at scale. • Confirmation from Burns & McDonnell of technological/ geological feasibility would make a difference here.	• Kansas has the geological features that could take advantage of these systems

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ES-4	**FOSSIL FUEL AND NUCLEAR ELECTRICITY**				
4.1	Advanced Fossil Fuel Technology (e.g., IGCC, CCSR, Advanced Pulverized Coal, CFB) Incentives, Support, or Requirements	**H:** 9 **M:** 1 **L:** 1 **U:** 0	**H:** 8 **M:** 3 **L:** 0 **N:** 0 **U:** 0	• This is one of EPRI's identified strategies to mitigate CO_2 and ensure reliable electric supply. • Technology not commercially demonstrated and sequestration not yet able to be widely deployed. • Useful now for enhanced oil recovery if pipelines available • Unlikely to provide substantial reductions before 2020, but like compressed air energy storage, crucial investments for long-term • Need to net out other costs and benefits from the energy resource	• KSA 2007 Supp. 79-233 exempts any carbon capture, storage and recovery (CCSR) equipment from all property taxes. KSA 2007 Supp. 79-32,256 provides additional tax incentives for CCSR. • KSA 2007 Supp. 79-32,228 – 32,232 and 79-32,238 –32,241 provide tax credits and KSA 2007 Supp. 74-8949a authorizes Kansas Development Finance Authority financing for building and expanding integrated gasification combined-cycle (IGCC) plants. • The 2007 Kansas Energy Plan recommends that the KCC consider the value of lower-emission-coal generation and CCSR technologies when evaluating investments or purchase power agreements for IGCC with CCSR.
4.2	New Nuclear Capacity	**H:** 11 **M:** 1 **L:** 0 **U:** 0	**H:** 9 **M:** 1 **L:** 0 **N:** 0	• Nuclear is non-emitting but will be expensive to deploy widely. • Nuclear waste? • Wind and solar cannot	• KSA 2007 Supp. 79-230 has a property tax exemption for new nuclear facilities built near other nuclear facilities. • SB 586 (2008) provides electric utilities the ability to recover certain costs related

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			U: 1	meet base load requirements. Baseload energy is critical to national and economic security. • Need to net out other costs and benefits from the energy resource	to planning for new nuclear generation capacity.
4.3	Relicensing/Up-rating Existing Nuclear Power	**H:** 8 **M:** 1 **L:** 2 **U:** 0	**H:** 2 **M:** 1 **L:** 5 **N:** 0 **U:** 2	• Extending the useful life of existing facilities won't achieve additional reductions but it won't increase either. • Preserve existing portfolio • The need for additional baseload capacity in KS will, unfortunately, need to be addressed in the very near future. • There are 104 existing plants that must all meet re-licensing before new nuclear can contribute to GHG stabilization. Need to double, at a minimum, our capacity by 2030.	• Westar is exploring relicensing their current nuclear facilities.

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4.4	Efficiency Improvements and Repowering Existing Plants	**H:** 3 **M:** 6 **L:** 1 **U:** 2	**H:** 4 **M:** 2 **L:** 2 **N:** 0 **U:** 3		
4.5	Technology-Focused Initiatives	**H:** 2 **M:** 2 **L:** 2 **U:** 4	**H:** 1 **M:** 3 **L:** 1 **N:** 0 **U:** 5		
ES-5	**FUEL PRODUCTION, PROCESSING, AND DELIVERY**				
5.1	Oil and Gas Production: GHG Emission Reduction Incentives, Support, or Requirements	**H:** 0 **M:** 5 **L:** 3 **U:** 1	**H:** 2 **M:** 2 **L:** 4 **N:** 0 **U:** 1		• Several oil and gas production companies operating in Kansas are participating in EPA's Gas STAR program, a voluntary program to report and reduce methane emissions.
5.2	Natural Gas Transmission and Distribution	**H:** 0 **M:** 6 **L:** 3 **U:** 1	**H:** 3 **M:** 3 **L:** 3 **N:** 0 **U:** 1	• Current grid cannot supply fuel switching needs without exacerbating already high supply costs.	• Several oil and gas production companies operating in Kansas are participating in EPA's Gas STAR program, a voluntary program to report and reduce methane emissions.
5.3	Oil Refining: GHG Emission Reduction Incentives, Support, or Requirements	**H:** 0 **M:** 3 **L:** 3 **U:** 3	**H:** 3 **M:** 1 **L:** 2 **N:** 0 **U:** 3	• Low cost, if focused on cost of new regulation. High cost if focus is on implementation	

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5.4	Coal Production: GHG Emission Reduction, Incentives, Support, or Requirements	**H:** 0 **M:** 3 **L:** 3 **U:** 3	**H:** 3 **M:** 1 **L:** 2 **N:** 0 **U:** 3		
5.5	Coal-to-Liquids and Gas-to-Liquids Production: GHG Emission Reduction Incentives, Support, or Requirements	**H:** 1 **M:** 1 **L:** 5 **U:** 3	**H:** 5 **M:** 2 **L:** 0 **N:** 0 **U:** 3		
5.6	Low-GHG Hydrogen Production Incentives and Support	**H:** 2 **M:** 3 **L:** 2 **U:** 3	**H:** 3 **M:** 3 **L:** 0 **N:** 0 **U:** 4		

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5.7	Enhanced Oil Recovery	**H:** 2 **M:** 4 **L:** 2 **U:** 3	**H:** 1 **M:** 5 **L:** 3 **N:** 0 **U:** 2	• EOR produces oil that needn't be transported overseas, reducing emissions and increasing energy security. But its real value is producing infrastructure for CCS. Viewed in that way, cost per ton of reduction for sequestration is medium over long term. • Provides for CCRS while maintaining oil and gas supply to maintain security. Interim carbon storage sink until saline storage is developed.	• The National Energy Technology Laboratory is working with the University of Kansas (KU), the Kansas Geological Society, and others on an enhanced oil recovery project with CO_2 in Kansas.
ES-6	**CARBON CAPTURE AND STORAGE OR REUSE POLICIES AND BARRIER REMOVAL**				
6.1	CCSR Incentives, Requirements and/or Enabling Policies (Administration, Regulation, Liability, Incentives)	**H:** 7 **M:** 1 **L:** 1 **U:** 1	**H:** 5 **M:** 3 **L:** 0 **N:** 0 **U:** 2	• This will be a complex legal/regulatory initiative as well as an expensive initiative. • Difficulty to evaluate • Significant legal impediments reaming and transportation infrastructure is	• KSA 2007 Supp. 79-233 and KSA 2007 Supp. 79-32,245 provide property tax incentives for the sequestration of CO_2, beginning with Fiscal Year 2008. • EPA has put out a proposed rule on the Underground Injection Control Program for Carbon Dioxide Geologic Sequestration Wells. • Kansas Geological Survey is a partner in

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				immature and not nearly adequate for large scale CCS. • EOR is more developed in TX and in OK panhandle.	the Southwest Regional Partnership on Carbon Sequestration (SWP). SWP was developed as a part of the U.S. Department of Energy's effort to respond to global climate change. The SWP has been challenged to evaluate available technologies that capture and store CO_2 in the southwest region. The SWP includes portions of Arizona, Colorado, Kansas, Nevada, New Mexico, Oklahoma, Texas, Utah and Wyoming. Participants include the coal, oil, and gas industries; electric utilities; the Navajo Nation; nongovernmental organizations; universities; and U.S. federal agencies. • The use of sequestered CO_2 to enhance oil recovery is of great interest due to the rise in the price of crude oil. Wellfields that were once marginal may be brought back to production. Some of these efforts include: ○ An ongoing project at the University of Kansas Energy Research Center (ERC), which includes research by the KU Tertiary Oil Recovery Project, the Kansas Geological Survey, and the ERC for enhanced oil recovery in Kansas using miscible-CO_2 flooding. ○ A partnership between Coffeyville Resources Nitrogen Fertilizers and Blue Source to develop options for the utilization of CO_2

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					captured from petroleum coke gasification-based ammonia and urea ammonium nitrate production. Particular focus is proposed to develop an enhanced oil recovery project.
6.2	R&D for CCSR	**H:** 4 **M:** 3 **L:** 2 **U:** 1	**H:** 3 **M:** 3 **L:** 3 **N:** 0 **U:** 1	• Local sequestration pilot projects are needed for evaluating KS potential. • Algae project needs funders for Phase 1B and Phase 2 (originally called Phase 2 and Phase 3). • CCRS essential for energy security beyond 2025. Current R&D is essential for CCRS development. This is a key 50-year infrastructure issue.	• Various carbon sequestration research efforts exist in Kansas, including KU ERC and Kansas State University's Soil Carbon Center. • Carbon reuse opportunities are proposed by Sunflower Electric for the Holcomb facility. Utilization of flue-gas for the enhanced production of algae for integration with the production of high-value products. Has potential application in many industrial facilities that use conventional fossil fuel.
6.3	Use CO_2 for Enhanced Oil Recovery	**H:** 5 **M:** 3 **L:** 2 **U:** 1	**H:** 2 **M:** 6 **L:** 3 **N:** 0 **U:** 0	• Market immature in KS. Transport via pipeline in infancy. • See note per 5.7 • Technology already developed	• The National Energy Technology Laboratory is working with the University of Kansas (KU), the Kansas Geological Society, and others on an enhanced oil recovery project with CO_2 in Kansas.
ES-7	**OTHER ENERGY SUPPLY OPTIONS**				
7.1	Transmission System Upgrading	**H:** 6 **M:** 2	**H:** 6 **M:** 2	• Upgrades for reliability have limited potential.	• Kansas Electric Transmission Authority was created to manage transmission

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		L: 1 **U:** 3	**L:** 1 **N:** 0 **U:** 3	• Upgrades for energy export, including renewable energy may progress. • Prime mover for export upgrades (Holcomb expansion) await PSD construction permit. • Large exports of wind need additional system reliability evaluation. • Transmissions, if built to facilitate wind energy distribution – and to reduce congestion to move wholesale power more efficiently – could notably reduce GHG emissions. Huge upfront capital investment, but huge long-term payoff. • Essential to the integration of wind and concentrated solar throughout Kansas.	issues and upgrades. • Westar is in the process of siting a new 765 kV transmission line.

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7.2	Reduction of Transmission and Distribution Line Losses	**H**: 1 **M:** 5 **L:** 2 **U:** 2	**H:** 3 **M:** 1 **L:** 3 **N:** 0 **U:** 3	• These need to be identified as upgrades for evaluation. • Distribution line losses are, potentially, a larger and more effective source of carbon reductions for some smaller utilities than even the most well-constructed and implemented energy efficiency or conservation programs.	
7.3	General Distributed Generation Support (Interconnection Rules, Net Metering, etc.)	**H:** 2 **M:** 2 **L:** 7 **U:** 0	**H:** 3 **M:** 6 **L:** 2 **N:** 0 **U:** 0	• Distributed generation will be important in the long term, but costly in the short-term. Likely a second-tier investment	• K.S.A. 66-1238 required KCC to establish standard provisions for interconnection with renewable energy generators. See also K.S.A. 66-1,184 • Utilities are required to pay 150% of the monthly system average cost per kilowatt-hour for customer-supplied renewable generation, up to 200 kW. See also K.S.A. 66-1,184 for exceptions.
7.4	Environmental/GHG Emissions Disclosure	**H:** 0 **M:** 1 **L:** 7 **U:** 2	**H:** 0 **M:** 2 **L:** 5 **N:** 0 **U:** 3		

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7.5	Landfill Gas Recovery	**H:** 0 **M:** 4 **L:** 6 **U:** 1	**H:** 0 **M:** 2 **L:** 6 **N:** 0 **U:** 3		• KSA 2007 Supp. 79-201 provides a property tax exemption for land used to collect, refine, transport, or treat landfill gas and for the gas itself.
7.6	Waste to Energy	**H:** 2 **M:** 5 **L:** 4 **U:** 1	**H:** 0 **M:** 8 **L:** 1 **N:** 0 **U:** 3	• Maximum benefit from CAFO for beef not demonstrated. Swine and dairy more certain. • Waste to flare may be more practical for GHG reduction than for energy reduction. • If better processes existed for dry waste, feedlots could do much more in this area; if wet waste only, we make use of a small percentage of manure generated in state. • Need to consider other wastes such as biomass, ash, wood wastes, used oil, etc. Estimates for existing facilities using co-firing.	• Anaerobic digesters can recycle agricultural and ethanol by-products as fuels and as feedstock for other bioenergy facilities as are proposed by Sunflower Electric for the Holcomb facility.

Option No.	GHG Reduction Policy Option	Potential GHG Emission Reductions	Cost per Ton	Externalities, Feasibility Considerations	Notes/Related Actions in Kansas
7.7	N_2O Reduction Co-Benefit	**H:** 0 **M:** 4 **L:** 3 **U:** 3	**H:** 1 **M:** 5 **L:** 0 **N:** 0 **U:** 4	• What does this mean?	
7.8	Smart Grid Systems	**H:** 1 **M:** 5 **L:** 1 **U:** 4	**H:** 3 **M:** 4 **L:** 0 **N:** 0 **U:** 4	• Needs definition • Smart grid could facilitate tremendous EE. Short term capital investment high; payoff in 2020 window could be high depending on speed of installation.	
7.9	Consider Expanded Hydroelectric Power Opportunities	**H:** 0 **M:** 3 **L:** 8 **U:** 0	**H:** 4 **M:** 6 **L:** 1 **N:** 0 **U:** 0	• Very limited opportunity in KS.	• Kansas has many reservoirs that discharge a lot of water each year, which could offer small-scale hydropower opportunities. • Kansas has one hydropower facility, the Bowersock Mills & Power Company facility at Lawrence on the Kansas River. The Bowersock facility is comprised of 7 hydroelectric turbines and is capable of producing 2.5 MW.
ES-8	**EDUCATION AND OUTREACH**				
8.1	General Education to Public on Energy Supply Options	**H:** 2 **M:** 3 **L:** 2 **U:** 2	**H:** 0 **M:** 2 **L:** 5 **N:** 0 **U:** 2		• Some energy generation facilities in Kansas provide educational public tours, such as the Bowersock hydro facility.

Option No.	GHG Reduction Policy Option	Potential GHG Emission Reductions	Cost per Ton	Externalities, Feasibility Considerations	Notes/Related Actions in Kansas
8.2	Work Force Development Education to Support Energy Supply Options and Economic Development	**H:** 2 **M:** 3 **L:** 3 **U:** 2	**H:** 0 **M:** 2 **L:** 5 **N:** 0 **U:** 3	• These are infrastructure requirements for workforce education. They enable certain technologies in one sense.	• The community college system in Kansas could be a model to develop and deploy educational and technical curricula to support work force development needs associated with potential actions. • Cloud County Community College has a wind energy education program. • The Kansas state universities have been involved in energy education for more than 30 years, and have research centers that focus on these issues.