

Approved: February 26, 2009

Date

MINUTES OF THE SENATE UTILITIES COMMITTEE

The meeting was called to order by Chairman Pat Apple at 1:30 p.m. on February 17, 2009, in Room 446-N of the Capitol.

All members were present.

Committee staff present:

Mike Corrigan, Office of the Revisor of Statutes
Melissa Doeblin, Office of the Revisor of Statutes
Raney Gilliland, Kansas Legislative Research Department
Cindy Lash, Kansas Legislative Research Department
Ann McMorris, Committee Assistant

Conferees appearing before the committee:

Ray Hammarlund, Kansas Corporation Commission

Others attending:

See attached list.

Chairperson Apple opened the meeting.

Approval of Minutes

Moved by Senator Bruce, seconded by Senator Petersen, to approve the minutes of the Senate Utilities Committee meetings held on February 5, 2009 and February 11, 2009. Motion carried.

Presentation on Kansas Energy Programs Division

Ray Hammarlund, Director, Kansas Corporation Commission Energy Programs Division, explained the mission statement of the Energy Programs Division is to promote energy conservation and efficiency in Kansas and to provide information on alternative energy and other energy topics. EPD has three primary functions: (1) administer energy efficiency programs; (2) deliver public information and outreach; and (3) foster coordination of state and federal initiatives and programs related to energy efficiency and alternative energy. He offered a detailed explanation of each of the EPD functions. The main energy efficiency program is the Facility Conservation Improvement Program (FCIP). A map of Kansas showing the FCIP projects in Kansas was discussed.

Liz Brosius, KCC, answered questions about their new updated website which will be designed to provide easy-to-access information on energy topics and issues and state and federal programs. The new website will be functioning soon.

Data on Kansas Electric Generation (1) summary of existing power plants; and (2) capacity and peak load, 2008 to 2028 was distributed. Color maps covering (1) Kansas wind resources; (2) Kansas solar resources; and (3) North American Cap-in-Trade Initiatives were discussed. (Attachment 1)

The next meeting is scheduled for February 18, 2009.

The meeting was adjourned at 2:30 p.m.

Respectfully submitted,

Ann McMorris
Committee Assistant

Attachments - 1

GUEST LIST
SENATE UTILITIES COMMITTEE
FEBRUARY 17, 2009

<u>NAME</u>	<u>COMPANY</u>
Ray Hammorlund	KCC
C/2 Blasius	kcc
Nelson Krueger	PAR
Bob Johnson	SEPC
CLARE GUSTIN	u
Bob Kuhlend	KIOGA
Nick Sordy	Capitol Strategus
Mark [unclear]	KMHA
Ron Seiber	KAXA
Mick Urban	Kansas Gas Service

KCC ENERGY PROGRAMS DIVISION

The mission of the Energy Programs Division is to promote energy conservation and efficiency in Kansas and to provide information on alternative energy and other energy topics.

In support of this mission, the division ...

- administers energy efficiency programs,
- delivers public information and outreach, and
- fosters coordination of state and federal initiatives and programs related to energy efficiency and alternative energy.

PROGRAMS

Facility Conservation Improvement Program (FCIP)—The FCIP, administered by the staff of the Energy Programs Division, is a program that helps finance facility improvements in state, municipal, county, and school structures using a tool known as energy savings performance contracting. The program connects public entities with pre-approved, private energy service companies (ESCOs) that identify energy savings opportunities and then recommend a package of improvements that are paid for by the savings generated.

The FCIP has completed over 50 improvement projects and currently has another 20 projects either under construction or in the preliminary or investment grade audit stage. To date, all the projects complete are collectively savings Kansas taxpayers approximately over \$11 million in annual energy savings.

In response to Executive Directive 07-373, the FCIP has increased the marketing of the program's benefits to the state's unified school districts. USDs, currently make up the largest portion of FCIP participants. The 15 USDs with projects completed or under construction have achieved a combined annual savings of approximately \$925,000.

As public entities continue to compete for increasingly limited financial resources, the FCIP remains a cost-effective method to implement much-needed facility improvements without the need of capital dollars (<http://www.kcc.ks.gov/energy/fcip/index.htm>).

OUTREACH

Kansas Wind and Renewable Energy Conference—Division staff organized the 9th annual conference, held in Topeka on September 23 – 24, 2008. Over 760 people attended the conference, which included a record number of exhibitors, several keynote speakers, and numerous presentations on a range of renewable energy and energy efficiency topics and issues. Plans are underway for the 2009 conference.

USDA Rural Development Funds for Energy Efficiency & Alternative Energy—Using a one-time \$50,000 grant from the National Governor's Association, the Division hired a consultant to increase the utilization of these funds by rural Kansans. Compared to other states, Kansas has not availed itself of these grant and loan funds as effectively: from 2001 to 2008, Kansas received roughly \$1.8 million, whereas Nebraska received \$16.4 million, Minnesota received \$27.9 million,

and Iowa received \$55.3 million. The purpose is to build a support and facilitation network to assist applicants in their funding request for USDA RD funds.

Governor's Booth at the State Fair—Division staff coordinated with the Governor's office to promote energy conservation at the Kansas State Fair, where 5,000 compact fluorescent light bulbs (donated by WalMart) were given away and fairgoers learned about energy savings through interactive electric meter display and educational publications.

POLICY

Kansas Energy Council—Division staff supported the work of the Kansas Energy Council in 2008, during which the Council focused on developing a better understanding of electricity generation in Kansas and policies to reduce greenhouse gas emissions. In support of committee activities, staff prepared summaries of resources related to greenhouse gas policy (<http://www.kec.kansas.gov/mga/index.htm>) and tables summarizing the state's existing generating units as well as current and projected capacity and peak demand through 2028 (<http://www.kec.kansas.gov/reports.htm>). The Council sponsored a September 3rd public presentation on national climate policy by Yale environmental economist Robert Repetto. The *Kansas Energy Report 2009* contains the Council's recommendations, which, along with related background information, were delivered to the Governor, Legislature, and KCC January 7, 2009. The Governor dissolved the Council on December 31, 2008.

Midwestern Governor's Association—In November, 2007, Governor Sebelius signed the Midwestern Greenhouse Gas Accord and associated Platform. The purpose of the Accord and Platform is to inform the national debate on climate policy and any resulting federal legislation that may arise in the next few years. The Kansas delegation has been very aggressive in bringing a Kansas perspective to the debate and has advocated strongly for positions that will benefit the Kansas economy and its industry and agriculture. To date, the delegation has aggressively advocated for the inclusion of offsets (both terrestrial and geologic) in federal cap-and-trade policy and identified issues associated with the Low Carbon Fuel Standard.

Kansas Wind Working Group—Division staff also assist the Lt. Governor's staff in coordinating the activities of this working group, established by the Governor in 2008. The group met four times last year and will meet again in Topeka on February 20, 2009. More information is available online (<http://wwg.kansas.gov>).

OTHER PROJECTS SUPPORTED BY DIVISION FUNDS

Resource Maps—New maps showing wind speeds and power densities at different heights (from 30 to 100 meters) were prepared by the National Renewable Energy Laboratory. Another map showing the state's solar resource was also prepared by an outside contractor.

Energy Conservation Education—As recommended by the Kansas Energy Council, the Division will provide \$30,000 to the Kansas Association for Conservation and Environmental Education (KACEE) to deliver K-12 energy conservation education as one component of its Kansas Green Schools Program, a joint initiative with KDHE.

Kansas Energy Council

Recommendations included in *Kansas Energy Report 2009*

The Kansas Energy Council approved the following recommendations for inclusion in the 2009 version of the *Kansas Energy Report*. The *Report* was delivered to the Governor, Legislature, and Kansas Corporation Commission on January 7, 2009.

Chapter 2, Section 2.3: Energy, Economics, and the Environment: Greenhouse Gas Emissions and Global Climate Change

1. If a cap-and-trade policy or carbon tax is passed, it should be done at the federal level.
2. Endorse policies that promote declines in greenhouse gas emissions, not policies that merely shift emissions within or between regions.
3. Urge Congressional delegation to include agricultural sequestration as an offset in any federal cap-and-trade policy.

Chapter 8, Section 8.4: Electricity: Electricity Generation and Carbon Dioxide Emissions

1. Encourage federal funding of research and development of all technologies that can provide base-load power while achieving reduced CO₂ emissions.
2. Encourage the Kansas Bioscience Authority to allocate some of their funds to research and development related to biomass-fueled electric generation, including the analysis of carbon footprint.
3. Endorse collaborative development of advanced generation technologies in Kansas that can provide base-load power while reducing greenhouse gas emissions. Such collaboration could be between Kansas utilities, between Kansas utilities and regional utilities, or between Kansas utilities and other stakeholders.

Chapter 9, Section 9.4: Energy Conservation and Efficiency: Public Sector

1. The State of Kansas should adopt a goal of increasing energy efficiency such that the rate of growth in electricity peak demand and total energy is 50% less than it would have been absent the energy efficiency initiative.
2. Establish minimum building design standard for all new and renovated, occupied, majority State-funded construction in accordance with LEED Platinum or design equivalent.

Chapter 10, Section 10.1: Energy Use in the Transportation Sector: Cars, Light Trucks

1. Encourage State agencies to develop guidelines for telecommuting for appropriate state employees, giving broad discretion to State agencies on how such an option would be applied.

Chapter 11, Section 11.1: Energy Use in the Agricultural Sector: Crop Agriculture

1. Increase state agency and private sector efforts to educate farmers (and agricultural landowners) about the benefits—reduced CO₂ emissions, energy and dollar savings—associated with no-till agriculture and existing state and federal conservation programs.

The *Kansas Energy Report* is available online at http://www.kec.gov/energy_plan.htm

**Kansas Corporation Commission
Energy Programs Division**

Ray Hammarlund, Director
Presentation to the Senate Utilities Committee
February 17, 2009

Mission Statement

The mission of the Energy Programs Division is *to promote energy conservation and efficiency in Kansas and to provide information on alternative energy and other energy topics.*

EPD's three primary functions

- Administer energy efficiency programs.
- Deliver public information and outreach.
- Foster coordination of state and federal initiatives and programs related to energy efficiency and alternative energy.

Function #1: EE Programs

- Primary program is the Facility Conservation Improvement Program (FCIP)
- Additional efforts are aimed at coordination with other state and federal programs: KEEP, LIHEAP, WAP, USDA-RD, and KACEE (Green Schools and EC/EE)

Facility Conservation Improvement Program (FCIP)

- A client-funded program for local units of government to implement energy efficiency upgrades in public buildings.
- Three Parties
 - FCIP staff
 - Local Unit of Government
 - Energy Service Companies (ESCO's)

The concept of FCIP is simple

- Performance Contracting
 - Allows customers to cash flow capital improvements for energy efficiency at the front end of the project and pay for that capital investment by energy savings over the life of the improvements.

Why FCIP?

- FCIP staff
 - Provides information at the point of transaction
 - Provides for and encourages balanced risk-sharing by both contracting parties and careful review of financial and energy saving assumptions.
 - Without FCIP, local units of government with limited resources may enter contracts with insufficient information to negotiate from a position of strength.
- See map for locations of FCIP projects.

Function #2: Public Information & Outreach

- Annual Conference
- State Fair Booth
- Kansas Wind Working Group, funding and coordination with Lt. Gov. office
- Numerous speaking engagements with entities, groups, and communities
- Solar Roundtable on March 3, 2009

Updated Website with ...

- Easy-to-access information on
 - energy topics and issues
 - state and federal programs
- Fact sheets and FAQs
- Updated Wind Resource maps for Kansas
- New Solar Resource maps for Kansas

1-6

Function #3: Coordination and Promotion

- USDA Rural Development 9007
 - Greatest source of underutilized funds
 - \$50,000 grant from the National Governors Association to hire a consultant and build a network to assist applicants
- KHRC's Low-interest EE Loan (KEEP)
 - Will coordinate with KHRC, and if necessary, dedicate DOE funds to its promotion.
- Energy Conservation Education
 - Green Schools (KACEE-KDHE funded)

Wind for Schools

- \$5,000 of DOE funds awarded to five districts (\$1,000 each)
 - Pretty Prairie
 - Deerfield
 - South Barber
 - Blue Valley
 - Greenbush (Girard)

Midwestern Governor's Association

- Climate Change Accord and Platform (map)
- MGA agreement to inform the national debate
- Kansas efforts have expanded terrestrial carbon offsets and informed the national discussion on a Low Carbon Fuel Standard (LCFS)

1-7

Kansas Energy Council

- Dissolved by Executive Order 08-13.
- The 2009 report contains background information & recommendations developed during 2008.
- Summary tables on Kansas electrical generation to be maintained and updated.
- Background resources on GHG policy & economics are available online:
<http://www.kec.kansas.gov/mga/index.htm>

Questions?

Ray Hammarlund
Director, KCC Energy Programs Division
785-271-3179
r.hammarlund@kcc.ks.gov

1-8

6-1

Kansas Electric Generation: Summary of Existing Power Plants, as of September 30, 2007
Kansas Energy Council (KEC) Staff Summary, Prepared for the KEC Electricity Committee

The table below contains information on the major electric generation facilities currently operating in Kansas, exclusive of intermittent power generation sources.¹ Generating units are identified as base load, intermediate, peaking, standby, and load-following.² Basic information in the first five columns comes from U.S. Department of Energy, Energy Information Administration (EIA) Form 860 for 2006,³ supplemented in some instances by updates from the utilities. Gross and net generation and carbon dioxide (CO₂) emissions data were provided by the individual utilities (with a few exceptions), with the emissions rates based on gross generation and Continuous Emissions Monitoring System (CEMS) data, where available.⁴

Utility / Operator	Power Plant Name Unit / Primary Fuel Source / Type (B = Base load, I = Intermediate, P = Peaking, S = Standby, LF = Load following)	County	Summer Capacity (MW)	Initial Year of Operation	Gross Generation (MWh) 10/1/2006 - 9/30/2007	Net Generation (MWh) 10/1/2006 - 9/30/2007	CO ₂ Emissions Rate (Gross) (tons/MWh) 10/1/2006 - 9/30/2007
Wolf Creek Nuclear Generating Corp. <i>(owned by Westar, KCP&L, KEPCo)</i>	Wolf Creek 1: Nuclear (B)	Coffey	1,160	1985	9,697,461	9,343,797	0
Westar <i>(includes KGE assets; Emporia Energy Center came online in 2008⁵)</i>	Jeffrey Energy Center 1: Coal (B)	Pottawatomie	730	1978	5,670,669	5,189,383	1.024
	2: Coal (B)		730	1980	5,776,659	5,325,549	1.029
	3: Coal (B)		730	1983	5,220,786	4,800,520	0.957
	Lawrence Energy Center 3: Coal (B)	Douglas	48	1955	397,840	352,074	1.283
	4: Coal (B)		110	1960	865,604	756,339	1.214
	5: Coal (B)		373	1971	2,599,968	2,402,377	1.025
	Hutchinson GT1: Natural gas (P)	Reno	51	1974	1,260	891	0.693
	GT2: Natural gas (P)		55	1974	1,162	726	0.612
	GT3: Natural gas (P)		56	1974	2,297	1,863	0.795
	GT4: Distillate fuel oil		75	1975	69	69	1.59
H1DG: Distillate fuel oil (S)	3		1983	19	19	0.88	
ST1: Natural gas (P), retired 12/06	17		1950	NA	NA	NA	
ST2: Natural gas (P), retired 12/06	16		1950	NA	NA	NA	
ST3: Natural gas (P), retired 12/06	28		1951	NA	NA	NA	
ST4: Natural gas (I)	170	1965	150,872	133,240	0.610		
Abilene GT1: Natural gas (P)	Dickinson	72	1973	6,835	6,739	0.693	

1-10

Utility / Operator	Power Plant Name Unit / Primary Fuel Source / Type (B = Base load, I = Intermediate, P = Peaking, S = Standby, LF = Load following)	County	Summer Capacity (MW)	Initial Year of Operation	Gross Generation (MWh) 10/1/2006 - 9/30/2007	Net Generation (MWh) 10/1/2006 - 9/30/2007	CO ₂ Emissions Rate (Gross) (tons/MWh) 10/1/2006 - 9/30/2007			
	Tecumseh 1: Natural gas (P) 2: Natural gas (P) 7: Coal (B) 8: Coal (B)	Shawnee	19 20 74 130	1972 1972 1957 1962	129 123 596,101 1,009,622	-135 -141 530,575 914,065	0.98 0.98 1.164 1.076			
	Gordon Evans (formerly KGE) ST1: Natural gas (P) ST2: Natural gas (S) 5: Distillate fuel oil (P) GT1: Natural gas (P) GT2: Natural gas (P) GT3: Natural gas (P)	Sedgwick	152 374 3 74 72 150	1961 1967 1969 2000 2000 2001	127,743 390,933 41 11,969 10,099 44,363	112,134 363,756 41 10,044 9,190 44,162	0.594 0.657 0.880 0.641 0.738 0.660			
	Murray Gill (formerly KGE) 1: Natural gas (P) 2: Natural gas (P) 3: Natural gas (P) 4: Natural gas (P)	Sedgwick	40 71 104 102	1952 1954 1956 1959	4,935 16,204 76,809 74,250	3,349 13,329 68,474 66,022	0.622 0.585 0.731 0.631			
	Neosho (formerly KGE) 3: Natural gas (P)	Labette	67	1954	9,681	7,187	0.555			
	KCP&L	LaCygne 1: Coal (B) 2: Coal (B)	Linn	736 682	1973 1977	5,515,799 5,766,795	4,994,470 5,436,128	1.016 1.005		
		Osawatomie 1: Natural gas (P)	Miami	77	2003	10,180	9,536	0.781		
		West Gardner 1: Natural gas (P) 2: Natural gas (P) 3: Natural gas (P) 4: Natural gas (P)	Johnson	77 77 77 77	2003 2003 2003 2003	26,933 25,586 26,171 24,541	26,184 24,800 25,414 23,895	0.733 0.742 0.736 0.726		
			KCBPU	Quindaro GT1: Natural gas (P) GT2: Distillate fuel oil (P) GT3: Distillate fuel oil (P) ST1: Coal (B) ST2: Coal (B)	Wyandotte	13 56 46 72 111	1969 1974 1977 1965 1971	346 2,452 1,055 529,203 689,347	174 2,101 737 494,038 626,947	0.930 1.099 1.214 1.136 1.156

11-1

Utility / Operator	Power Plant Name Unit / Primary Fuel Source / Type (B = Base load, I = Intermediate, P = Peaking, S = Standby, LF = Load following)	County	Summer Capacity (MW)	Initial Year of Operation	Gross Generation (MWh) 10/1/2006 - 9/30/2007	Net Generation (MWh) 10/1/2006 - 9/30/2007	CO ₂ Emissions Rate (Gross) (tons/MWh) 10/1/2006 - 9/30/2007
	Nearman Creek ST1: Coal (B) GT1: Natural gas (P)	Wyandotte	229 76	1981 2006	1,790,658 24,734	1,628,875 23,925	1.232 0.875
Sunflower (Cimarron River, Clifton, Fort Dodge, and Great Bend stations owned by Mid-Kansas Electric Company)	Holcomb Station H1: Coal (B)	Finney	360.0	1983	3,031,141.5	2,823,615	0.9945
	Garden City Station GC3: Natural gas (I) S2: Natural gas (I) S3: Natural gas (P) S4: Natural gas (P) S5: Natural gas (P)	Finney	8.7 98.0 14.5 51.0 53.0	1962 1973 1968 1976 1979	21 40,309 62 9,620 6,486	-372 34,187 -58 9,399 6,138	1.367 0.577 1.519 0.820 0.754
	Cimarron River Station CR1: Natural gas (I) CR2: Natural gas (P)	Seward	61.0 15.5	1963 1967	153,160 54	142,999 54	0.704 0.735
	Clifton Station CL1: Natural gas (P) CL2: Distillate fuel oil (P)	Washington	73.1 2.5	1974 1974	20,058 6	19,476 6	0.922 0.861
	Fort Dodge Station FDS4: Natural gas (LF) (formerly Judson Large)	Ford	144.6	1968	461,134	427,579	0.640
	Great Bend Station GB3: Natural gas (I) (formerly Arthur Mullergren)	Barton	98.5	1963	139,625	128,117	0.641
	Riverton 10: Natural gas (P) 11: Natural gas (P) 12: Natural gas (I) 7: Coal (B) 8: Coal (B) 9: Natural gas (P)	Cherokee	16 16 150 38 54 12	1988 1988 2007 1950 1954 1964	2,138 187 91,193 205,626 359,098 880	2,138 187 90,150 190,137 337,254 880	0.978 0.985 0.708 1.369 1.292 0.985
City of McPherson	McPherson 2 GT1: Natural gas (P) GT2: Distillate fuel oil (P) GT3: Natural gas (P)	McPherson	51.8 52.5 52.2	1973 1976 1979	3,251 408 1,758	3,234 405 1,748	0.813 0.993 0.800
	McPherson 3 NA1: Natural gas (P)	McPherson	79.3	1998	25,639	25,404	0.792

21-1

Utility / Operator	Power Plant Name Unit / Primary Fuel Source / Type (B = Base load, I = Intermediate, P = Peaking, S = Standby, LF = Load following)	County	Summer Capacity (MW)	Initial Year of Operation	Gross Generation (MWh) 10/1/2006 - 9/30/2007	Net Generation (MWh) 10/1/2006 - 9/30/2007	CO ₂ Emissions Rate (Gross) (tons/MWh) 10/1/2006 - 9/30/2007
Midwest Energy (Note: Goodman Energy Center came online in 2008) ⁵	Colby GT: Dual Fuel (P)	Thomas	13.0	1970	0	296	N/A
	Great Bend 1: Dual Fuel (P) 2: Dual Fuel (P) 3: Dual Fuel (P) 4: Dual Fuel (P) 5: Dual Fuel (P) 6: Dual Fuel (P)	Barton	1.0 1.0 1.0 1.0 3.0 3.0	1948 1948 1948 1948 1956 1956	38	-41	N/A
	Bird City 1: Distillate fuel oil (P)	Cheyenne	2.0	1965	0	-69	N/A
	Kansas River Project 1,3-7: Hydro (B)	Douglas		1922-1925		10,329	0

Notes

¹ An intermittent electric generator or resource is "an electric generating plant with output controlled by the natural variability of the energy resource rather than dispatched based on system requirements. Intermittent output usually results from the direct, non-stored conversion of naturally occurring energy fluxes such as solar energy, wind energy, or the energy of free-flowing rivers (that is, run-of-river hydroelectricity)." From EIA's Energy Glossary (http://www.eia.doe.gov/glossary/glossary_i.htm; accessed May 2008).

² *Base load units* produce electricity at an essentially constant rate and run continuously; they are operated to maximize system mechanical and thermal efficiency and minimize system operating costs. *Peaking units* are normally reserved for operation during the hours of highest daily, weekly, or seasonal loads. *Intermediate units*, as their name suggests serve the load in between base load and peak load. *Standby units* support a utility system and generally run under no-load. *Load following units* are used to maintain scheduled system frequency and are ramped up or down in response to changes in system frequency, tieline loading, or the relation of these to each other.

³ EIA, 2008, Electric Generation Capacity, Existing Electric Generating Units in the U.S., 2006: <http://www.eia.doe.gov/cneaf/electricity/page/capacity/capacity.html> (link to table; accessed January 2008).

⁴ Generation data for Bowersock is from EIA Form 906-920 (for 2006 and 2007). CO₂ emissions rates for McPherson BPU were calculated based on gross generation and fuel type by multiplying total consumption by the appropriate emissions coefficient for a fuel type, divided by the amount of production in MWh over the desired time period. Emissions coefficients come from the EIA's CO₂ Uncontrolled Emissions Factors webpage (<http://www.eia.doe.gov/cneaf/electricity/epa/epata3.html>). Generation data for Sunflower (and MKEC) units are based on actual plant watt-hour meter readings. KCBPU's emissions rates for Quindaro GT1, GT2, and GT3 were calculated from fuel data and EPA Emissions Factors.

⁵ Westar Energy's Emporia Energy Center has 300 MW (natural gas units) of peaking capacity; another 300 MW is scheduled to come online in 2009. Midwest Energy's Goodman Energy Center has 9 natural gas peaking units, each with a summer capacity of 8.4 MW.

1-13

Kansas Electric Generation: Capacity and Peak Load, 2008 to 2028

Kansas Energy Council (KEC) Staff Summary, Prepared for the KEC Electricity Committee

The tables presented below (Tables 1–3) contain information on current (2008) and forecasted (through 2028) capacity and peak load for the major utilities (and other entities) operating in Kansas. This information represents each utility's current forecasted position, including wholesale power contracts expected to be renewed in the future; it does not include new generation that is not currently approved or under construction. Data presented for KCP&L and Empire represents only the capacity and peak load associated with serving their Kansas customers.

Capacity from jointly owned generation facilities, exclusive of wind generation, is allocated among the owners as follows: **Wolf Creek (current):** Westar 47% (545 MW), KCP&L 47% (545 MW), and KEPCo 6% (70 MW); **Wolf Creek (2011 through 2028, due to improvements in operation):** Westar (565 MW), KCP&L (565 MW), and KEPCo (72.5 MW); **LaCygne:** Westar (709 MW) and KCP&L (709 MW); **State Line:** Westar 40% (200 MW) and Empire 60% (300 MW); **Iatan 1:** KCP&L 70% (455 MW), Aquila 18% (117 MW), and Empire 12% (78 MW).

Capacity from wind generation is either calculated from historical performance or estimated. For wind farms with sufficient historical performance data, capacity is calculated according to Southwest Power Pool's (SPP's) criterion:¹ **Gray County Wind Farm:** 10 MW; **Elk River Wind Farm:** 7 MW; **Spearville Wind Energy Facility:** 15 MW; and **Smoky Hills Wind Farm (2009 through 2028):**² 26 MW. Capacity for the following facilities, which will become operational at the end of 2008, are estimated as 5% of nameplate capacity: **Meridian Way Wind Farm (10 MW)**, **Flat Ridge Wind Farm (5 MW)**, and **Central Plains Wind Farm (5 MW)**. Where the power is owned or purchased by more than one utility, capacity is allocated as follows: **Meridian Way Wind Farm:** Empire (5 MW) and Westar (5 MW); **Smoky Hills Wind Farm:** Sunflower (7.8 MW).³

In general, the information for these tables was provided by the individual utilities, including their presentations to the KEC Electricity Committee (available on the KEC web site: <http://kec.kansas.gov/electricity/index.htm>). In addition, staff made calculations for KEPCo, whose forecasted peak load was calculated from data provided, and extended Westar's 10-year forecast to 20 years.

KEC staff thanks the following utility representatives for their assistance in compiling these data and for their presentations to the KEC Electricity Committee: Jim Ludwig, Executive Vice President of Public Affairs and Consumer Services, Westar Energy; Mark Schreiber, Director of Government Affairs, Westar Energy; John Grimwade, Senior Director of Strategic Planning, Kansas City Power and Light (KCP&L); Paul Snider, Manager of Government Affairs, Kansas City Power and Light (KCP&L); Blake Elliott, Director of Electric Supply Planning, Kansas City Board of Public Utilities (KCBPU); Corey Linville, Manager of Generation Expansion, Sunflower Electric Power Corporation; Kyle Nelson, Senior Vice President and Chief Operating Officer, Sunflower Electric Power Corporation; Todd Tarter, Manager of Strategic Planning, Empire District Electric Company; Bill Dowling, Vice President of Energy Management, Midwest Energy; Les Evans, Vice President of Power Supply, Kansas Electrical Power Cooperative (KEPCo); Jim Widener, General Manager, Kansas Municipal Energy Agency (KMEA); Neil Rowland, Director of Electric Operations, Kansas Municipal Energy Agency (KMEA); and Colin Whitley, General Manager, Kansas Power Pool (KPP).

¹ Southwest Power Pool's Generation Working Group (GWG), September 2004, Wind Power Capacity Accreditation White Paper, Southwest Power Pool (SPP): http://www.spp.org/publications/WindWhite04Sept8_rev5.pdf. Rated capacity for wind is defined as the minimum capacity value that can be expected 85% of the time during the top 10% of load hours in a given month.

² Phase 1, roughly 40% of the Smoky Hills Wind Farm, was completed in February 2008 and generation data during the summer of 2008 was used to calculate capacity for the entire project, which is expected to be operational at the end of 2008. Capacity from Smoky Hills during 2008 is not included in these tables.

³ Buyers Midwest and KC Board of Public Utilities do not include rated capacity from Smoky Hills Wind Farm within their net capacity totals.

1-14

Table 1—Overview of current and projected net capacity and capacity responsibility for major utilities and other entities in Kansas, 2008–2028. Net capacity includes existing and planned capacity from generating units (including rated capacity provided by wind generation), as well as any capacity purchased and sold through wholesale power contracts. Capacity responsibility reflects current and projected peak-load demand plus the minimum 12% capacity margin required by Southwest Power Pool (SPP).¹ Capacity responsibility is calculated as projected peak-load demand divided by 0.88.

Utility	Current (2008)		2013 Projected		2018 Projected		2023 Projected		2028 Projected	
	Net Capacity (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Capacity Responsibility (MW)
Westar	5,796.0	5,578.4	6,418.0	6,009.5	6,560.0	6,474.0	6,680.0	6,974.3	6,622.0	7,513.3
KCP&L	1,970.8	1,942.0	2,225.5	2,043.8	2,234.2	2,166.5	2,260.4	2,270.9	2,288.7	2,405.9
KC Board of Public Utilities	560.5	573.9	560.5	602.3	548.0	636.4	406.3	664.8	315.5	693.2
Sunflower and MKEC	1,185.5	1,163.6	1,350.3	1,328.4	1,350.3	1,364.8	1,178.1	1,360.2	1,178.1	1,395.5
Empire	69.1	67.4	68.3	70.6	63.0	74.3	58.7	78.7	54.7	83.6
Midwest Energy	359.0	354.5	379.0	369.5	362.5	378.4	358.0	388.6	358.0	398.9
Kansas Electrical Power Coop.	447.0	419.5	488.4	460.7	411.3	517.5	380.4	572.2	388.5	626.1
Kansas Municipal Energy Agency	323.0	219.2	277.0	247.2	273.0	268.6	273.0	289.4	228.0	311.8
Kansas Power Pool	445.6	331.9	625.8	449.2	618.8	484.3	534.8	507.7	534.8	532.6

¹ Per SPP criteria, load satisfied by firm power contracts and contracts that include reserve responsibility are included in capacity responsibility numbers without the additional capacity margin.

51-1

Table 2—Annual forecasted peak load, capacity responsibility, and net capacity for major utilities and other entities in Kansas, 2008–2028. Peak load is the amount of consumption during the period of maximum demand and, in this table, is synonymous with summer peak load. Capacity responsibility reflects current and projected peak-load demand plus the minimum 12% capacity margin required by Southwest Power Pool (SPP).¹ Capacity responsibility is calculated as projected peak-load demand divided by 0.88. Net capacity includes existing and planned capacity from generating units (including rated capacity provided by wind generation), as well as any capacity purchased and sold through wholesale power contracts (see Table 3 for details). Peak-load data was provided by the individual utilities except where noted.²

	Westar			KCP&L			KC Board of Public Utilities		
	Peak Load (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Peak Load (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Peak Load (MW)	Capacity Responsibility (MW)	Net Capacity (MW)
2008	4,909.0	5,578.4	5,796.0	1,709.0	1,942.0	1,970.8	505.0	573.9	560.5
2009	4,982.6	5,662.1	6,118.0	1,721.0	1,955.7	1,992.3	510.0	579.5	560.5
2010	5,057.4	5,747.0	6,426.0	1,738.9	1,976.0	2,121.9	515.0	585.2	560.5
2011	5,133.2	5,833.2	6,437.0	1,755.9	1,995.3	2,183.7	520.0	590.9	560.5
2012	5,210.2	5,920.7	6,428.0	1,775.7	2,017.9	2,201.0	525.0	596.6	560.5
2013	5,288.4	6,009.5	6,418.0	1,798.5	2,043.8	2,225.5	530.0	602.3	560.5
2014	5,367.7	6,099.7	6,600.0	1,826.3	2,075.3	2,231.3	535.0	608.0	560.5
2015	5,448.2	6,191.2	6,590.0	1,847.2	2,099.1	2,234.2	540.0	613.6	548.0
2016	5,530.0	6,284.0	6,580.0	1,870.0	2,124.9	2,223.0	545.0	619.3	548.0
2017	5,612.9	6,378.3	6,570.0	1,888.7	2,146.3	2,228.1	550.0	625.0	548.0
2018	5,697.1	6,474.0	6,560.0	1,906.5	2,166.5	2,234.2	560.0	636.4	548.0
2019	5,782.6	6,571.1	6,724.0	1,930.2	2,193.4	2,240.4	565.0	642.0	548.0
2020	5,869.3	6,669.6	6,713.0	1,951.0	2,217.1	2,244.3	570.0	647.7	492.0
2021	5,957.3	6,769.7	6,702.0	1,968.8	2,237.3	2,250.1	575.0	653.4	492.0
2022	6,046.7	6,871.2	6,692.0	1,982.7	2,253.0	2,254.2	580.0	659.1	419.7
2023	6,137.4	6,974.3	6,680.0	1,998.4	2,270.9	2,260.4	585.0	664.8	406.3
2024	6,229.5	7,078.9	6,669.0	2,022.1	2,297.9	2,267.2	590.0	670.5	426.3
2025	6,322.9	7,185.1	6,658.0	2,046.9	2,326.0	2,272.9	595.0	676.1	426.3
2026	6,417.7	7,292.9	6,646.0	2,066.7	2,348.6	2,276.3	600.0	681.8	315.5
2027	6,514.0	7,402.3	6,634.0	2,091.5	2,376.7	2,282.8	605.0	687.5	315.5
2028	6,611.7	7,513.3	6,622.0	2,117.2	2,405.9	2,288.7	610.0	693.2	315.5

1-16

Table 2, continued.

	Sunflower and MKEC			Empire			Midwest Energy		
	Peak Load (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Peak Load (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Peak Load (MW)	Capacity Responsibility (MW)	Net Capacity (MW)
2008	1,024.0	1,163.6	1,185.5	59.3	67.4	69.1	312.0	354.5	359.0
2009	1,040.0	1,181.8	1,352.3	59.9	68.0	70.5	318.0	361.4	364.0
2010	1,096.0	1,245.5	1,350.3	60.4	68.6	71.7	320.0	363.6	369.0
2011	1,131.0	1,285.2	1,350.3	60.9	69.3	70.6	322.0	365.9	369.0
2012	1,147.0	1,303.4	1,350.3	61.5	69.9	69.4	324.0	368.2	379.0
2013	1,169.0	1,328.4	1,350.3	62.1	70.6	68.3	325.0	369.3	379.0
2014	1,175.0	1,335.2	1,350.3	62.7	71.3	67.1	326.0	370.5	375.5
2015	1,182.0	1,343.2	1,350.3	63.3	72.0	66.0	328.0	372.7	371.5
2016	1,189.0	1,351.1	1,350.3	64.0	72.7	65.0	330.0	375.0	362.5
2017	1,196.0	1,359.1	1,350.3	64.7	73.5	64.0	332.0	377.3	362.5
2018	1,201.0	1,364.8	1,350.3	65.4	74.3	63.0	333.0	378.4	362.5
2019	1,173.0	1,333.0	1,178.1	66.1	75.1	62.1	335.0	380.7	358.0
2020	1,179.0	1,339.8	1,178.1	66.9	76.0	61.2	337.0	383.0	358.0
2021	1,185.0	1,346.6	1,178.1	67.6	76.9	60.4	339.0	385.2	358.0
2022	1,191.0	1,353.4	1,178.1	68.4	77.8	59.5	340.0	386.4	358.0
2023	1,197.0	1,360.2	1,178.1	69.2	78.7	58.7	342.0	388.6	358.0
2024	1,203.0	1,367.0	1,178.1	70.1	79.6	57.9	344.0	390.9	358.0
2025	1,210.0	1,375.0	1,178.1	70.9	80.6	57.0	345.0	392.0	358.0
2026	1,216.0	1,381.8	1,178.1	71.8	81.6	56.3	347.0	394.3	358.0
2027	1,222.0	1,388.6	1,178.1	72.7	82.6	55.5	349.0	396.6	358.0
2028	1,228.0	1,395.5	1,178.1	73.6	83.6	54.7	351.0	398.9	358.0

1-17

Table 2, continued.

	Kansas Electrical Power Coop. ³			Kansas Municipal Energy Agency			Kansas Power Pool		
	Peak Load (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Peak Load (MW)	Capacity Responsibility (MW)	Net Capacity (MW)	Peak Load (MW)	Capacity Responsibility (MW)	Net Capacity (MW)
2008	412.0	419.5	447.0	192.9	219.2	323.0	295.4	331.9	445.6
2009	419.2	427.1	451.3	199.9	227.2	275.0	318.4	355.0	499.2
2010	426.5	434.9	485.6	204.8	232.7	277.0	383.0	428.0	625.3
2011	434.0	442.7	492.5	210.1	238.7	277.0	389.4	434.8	625.8
2012	441.6	450.8	497.0	213.8	242.9	277.0	395.8	441.9	625.8
2013	449.3	460.7	488.4	217.5	247.2	277.0	402.1	449.2	625.8
2014	457.2	469.0	492.8	221.2	251.4	277.0	408.6	456.6	625.8
2015	465.2	477.5	497.3	224.9	255.6	277.0	415.2	464.1	625.8
2016	473.3	486.2	501.9	228.9	260.1	273.0	421.9	471.7	625.8
2017	481.6	508.6	406.5	232.9	264.7	273.0	428.8	479.5	625.8
2018	490.1	517.5	411.3	236.4	268.6	273.0	433.1	484.3	618.8
2019	498.6	533.7	364.0	239.9	272.7	273.0	436.9	488.7	618.8
2020	507.4	543.1	368.0	243.5	276.7	273.0	441.0	493.4	534.8
2021	516.2	552.6	372.1	247.2	280.9	273.0	445.2	498.1	534.8
2022	525.3	562.3	376.2	250.9	285.1	273.0	449.4	502.9	534.8
2023	534.5	572.2	380.4	254.7	289.4	273.0	453.7	507.7	534.8
2024	543.8	582.2	384.6	258.5	293.7	273.0	458.0	512.6	534.8
2025	553.3	594.4	375.0	262.4	298.1	273.0	462.3	517.5	534.8
2026	563.0	604.8	379.4	266.3	302.6	228.0	466.7	522.5	534.8
2027	572.9	615.3	383.9	270.3	307.1	228.0	471.1	527.5	534.8
2028	582.9	626.1	388.5	274.3	311.8	228.0	475.5	532.6	534.8

¹ Per SPP criteria, load satisfied by firm power contracts and contracts that include reserve responsibility are included in capacity responsibility numbers without the additional capacity margin.

² Peak load data for the years 2018 through 2028 were calculated by KEC staff from the 10 year forecast provided by Westar, assuming 1.5% annual growth.

³ Peak load data were calculated by KEC staff, using a 1.75% annual growth rate, based on the numbers provided in "Power Supply Overview," Kansas Electrical Power Cooperative PowerPoint presentation to the KEC Electricity Committee: <http://kec.kansas.gov/electricity/index.htm>.

81-1

Table 3—Current and forecasted capacity breakdown for major utilities and entities in Kansas, 2008–2028. Capacity from generation is the summation of the rated capacity of all of the power plants owned by the utility or entity, including wind generation. Net contracts represent capacity purchased and sold through wholesale power contracts, such as Power Purchase Agreements (PPA's), and is calculated as contracts purchased minus contracts sold (a negative number indicates that more capacity is sold than purchased, while a positive number indicates that more capacity is purchased than sold). Net capacity is the summation of capacity from generation and net contracts

	Westar			KCP&L			KC Board of Public Utilities		
	Capacity from Generation (MW)	Net Contracts (MW)	Net Capacity (MW)	Capacity from Generation (MW)	Net Contracts (MW)	Net Capacity (MW)	Capacity from Generation (MW)	Net Contracts (MW)	Net Capacity (MW)
2008	6,635.0	-839.0	5,796.0	1,915.9	54.9	1,970.8	613.5	-53.0	560.5
2009	6,965.0	-847.0	6,118.0	1,937.3	55.0	1,992.3	613.5	-53.0	560.5
2010	6,965.0	-539.0	6,426.0	2,171.8	-49.9	2,121.9	613.5	-53.0	560.5
2011	6,985.0	-548.0	6,437.0	2,190.9	-7.2	2,183.7	613.5	-53.0	560.5
2012	6,985.0	-557.0	6,428.0	2,207.5	-7.7	2,201.0	613.5	-53.0	560.5
2013	6,985.0	-567.0	6,418.0	2,208.7	16.8	2,225.5	613.5	-53.0	560.5
2014	6,985.0	-385.0	6,600.0	2,214.5	16.8	2,231.3	613.5	-53.0	560.5
2015	6,985.0	-395.0	6,590.0	2,217.4	16.8	2,234.2	601.0	-53.0	548.0
2016	6,985.0	-405.0	6,580.0	2,223.0	0	2,223.0	601.0	-53.0	548.0
2017	6,985.0	-415.0	6,570.0	2,228.1	0	2,228.1	601.0	-53.0	548.0
2018	6,985.0	-425.0	6,560.0	2,234.2	0	2,234.2	601.0	-53.0	548.0
2019	6,985.0	-261.0	6,724.0	2,240.4	0	2,240.4	601.0	-53.0	548.0
2020	6,985.0	-272.0	6,713.0	2,244.3	0	2,244.3	545.0	-53.0	492.0
2021	6,985.0	-283.0	6,702.0	2,250.1	0	2,250.1	545.0	-53.0	492.0
2022	6,985.0	-293.0	6,692.0	2,254.2	0	2,254.2	472.7	-53.0	419.7
2023	6,985.0	-305.0	6,680.0	2,260.4	0	2,260.4	421.3	-15.0	406.3
2024	6,985.0	-316.0	6,669.0	2,267.2	0	2,267.2	421.3	5.0	426.3
2025	6,985.0	-327.0	6,658.0	2,272.9	0	2,272.9	421.3	5.0	426.3
2026	6,985.0	-339.0	6,646.0	2,276.3	0	2,276.3	310.5	5.0	315.5
2027	6,985.0	-351.0	6,634.0	2,282.8	0	2,282.8	310.5	5.0	315.5
2028	6,985.0	-363.0	6,622.0	2,288.7	0	2,288.7	310.5	5.0	315.5

61-1

Table 3, continued.

	Sunflower and MKEC			Empire			Midwest Energy ¹		
	Generation (MW)	Net Contracts (MW)	Net Capacity (MW)	Generation (MW)	Net Contracts (MW)	Net Capacity (MW)	Generation (MW)	Net Contracts (MW)	Net Capacity (MW)
2008	980.2	205.3	1,185.5	63.1	6.0	69.1	71.0	288.0	359.0
2009	988.6	364.7	1,352.3	62.1	8.4	70.5	101.0	263.0	364.0
2010	988.6	364.7	1,350.3	68.7	3.0	71.7	101.0	268.0	369.0
2011	988.6	364.7	1,350.3	67.6	3.0	70.6	101.0	268.0	369.0
2012	988.6	364.7	1,350.3	66.5	2.9	69.4	101.0	278.0	379.0
2013	988.6	364.7	1,350.3	65.4	2.9	68.3	101.0	278.0	379.0
2014	988.6	364.7	1,350.3	64.3	2.8	67.1	101.0	274.5	375.5
2015	988.6	364.7	1,350.3	65.5	0.5	66.0	97.0	274.5	371.5
2016	988.6	364.7	1,350.3	64.5	0.5	65.0	88.0	274.5	362.5
2017	988.6	364.7	1,350.3	63.5	0.5	64.0	88.0	274.5	362.5
2018	988.6	364.7	1,350.3	62.5	0.5	63.0	88.0	274.5	362.5
2019	988.6	189.5	1,178.1	61.6	0.5	62.1	88.0	270.0	358.0
2020	988.6	189.5	1,178.1	60.7	0.5	61.2	88.0	270.0	358.0
2021	988.6	189.5	1,178.1	59.9	0.5	60.4	88.0	270.0	358.0
2022	988.6	189.5	1,178.1	59.1	0.5	59.5	88.0	270.0	358.0
2023	988.6	189.5	1,178.1	58.2	0.5	58.7	88.0	270.0	358.0
2024	988.6	189.5	1,178.1	57.4	0.5	57.9	88.0	270.0	358.0
2025	988.6	189.5	1,178.1	56.6	0.5	57.0	88.0	270.0	358.0
2026	988.6	189.5	1,178.1	55.8	0.5	56.3	88.0	270.0	358.0
2027	988.6	189.5	1,178.1	55.0	0.5	55.5	88.0	270.0	358.0
2028	988.6	189.5	1,178.1	54.2	0.4	54.7	88.0	270.0	358.0

Table 3, continued.

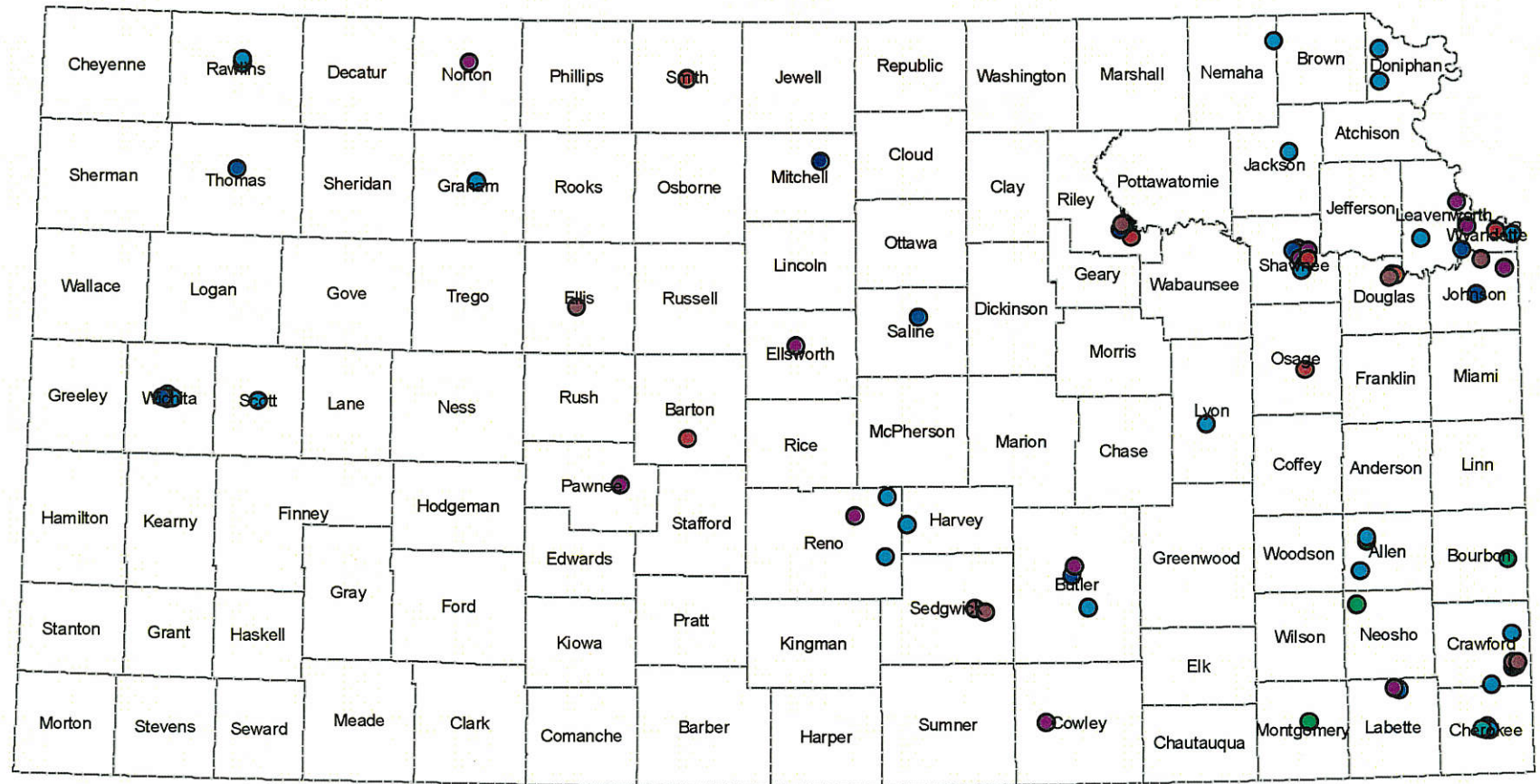
	Kansas Electrical Power Coop. ²			Kansas Municipal Energy Agency			Kansas Power Pool		
	Generation (MW)	Net Contracts (MW)	Net Capacity (MW)	Generation (MW)	Net Contracts (MW)	Net Capacity (MW)	Generation (MW)	Net Contracts (MW)	Net Capacity (MW)
2008	90.0	357.0	447.0	205.0	118.0	323.0	234.5	211.1	445.6
2009	90.0	361.3	451.3	205.0	70.0	275.0	237.7	261.5	499.2
2010	120.0	365.6	485.6	205.0	72.0	277.0	359.3	266.0	625.3
2011	122.5	370.0	492.5	205.0	72.0	277.0	359.3	266.5	625.8
2012	122.5	374.5	497.0	205.0	72.0	277.0	359.3	266.5	625.8
2013	122.5	365.9	488.4	205.0	72.0	277.0	359.3	266.5	625.8
2014	122.5	370.3	492.8	205.0	72.0	277.0	359.3	266.5	625.8
2015	122.5	374.8	497.3	205.0	72.0	277.0	359.3	266.5	625.8
2016	122.5	379.4	501.9	205.0	68.0	273.0	359.3	266.5	625.8
2017	122.5	284.0	406.5	205.0	68.0	273.0	359.3	266.5	625.8
2018	122.5	288.8	411.3	205.0	68.0	273.0	359.3	259.5	618.8
2019	122.5	241.5	364.0	205.0	68.0	273.0	359.3	259.5	618.8
2020	122.5	245.5	368.0	205.0	68.0	273.0	359.3	175.5	534.8
2021	122.5	249.6	372.1	205.0	68.0	273.0	359.3	175.5	534.8
2022	122.5	253.7	376.2	205.0	68.0	273.0	359.3	175.5	534.8
2023	122.5	257.9	380.4	205.0	68.0	273.0	359.3	175.5	534.8
2024	122.5	262.1	384.6	205.0	68.0	273.0	359.3	175.5	534.8
2025	122.5	252.5	375.0	205.0	68.0	273.0	359.3	175.5	534.8
2026	122.5	256.9	379.4	205.0	23.0	228.0	359.3	175.5	534.8
2027	122.5	261.4	383.9	205.0	23.0	228.0	359.3	175.5	534.8
2028	122.5	266.0	388.5	205.0	23.0	228.0	359.3	175.5	534.8

¹ Net contract data for Midwest Energy includes wholesale contracts that are under negotiation as of Fall 2008.

² "Power Supply Overview," Kansas Electrical Power Cooperative PowerPoint presentation to the KEC Electricity Committee, May 21, 2008: <http://kec.kansas.gov/electricity/index.htm>. Generation data for the years after 2010 include a 3.5% ownership of Iatan 2, currently under construction by KCP&L. Additionally, net contract data include contracts that adjust based on changes (growth) in peak load; for these, peak load growth is assumed to be 1.75% per year.

20-1

FCIP Projects in Kansas

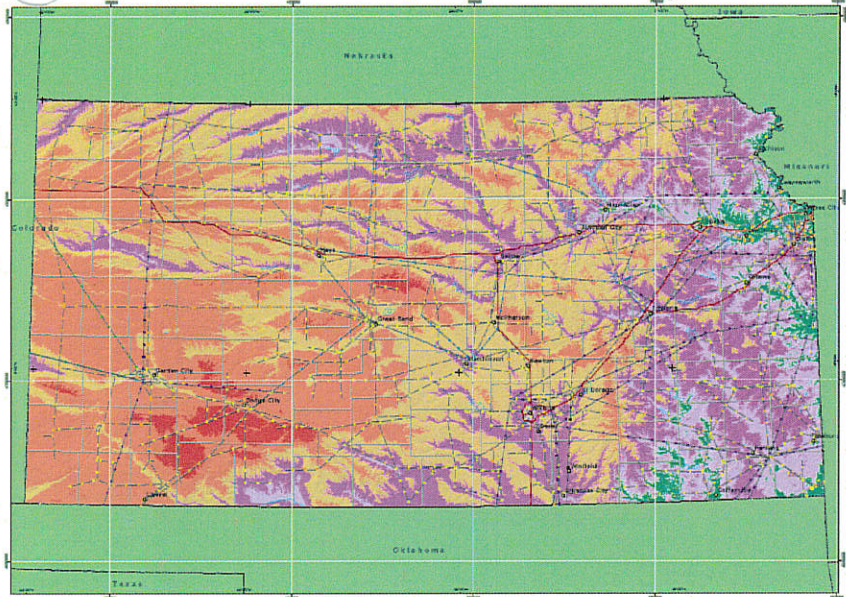


- FCIP Projects 2008**
- CITY
 - COUNTY
 - COMMUNITY COLLEGE
 - STATE
 - TECHNICAL COLLEGE
 - USD
 - OTHER
 - UNIVERSITY

KANSAS WIND RESOURCES - MEAN ANNUAL WIND SPEED – 100, 70, 50, 30 meters

1-22

WIND RESOURCE OF KANSAS Mean Annual Wind Speed at 100 Meters



MESOMAP

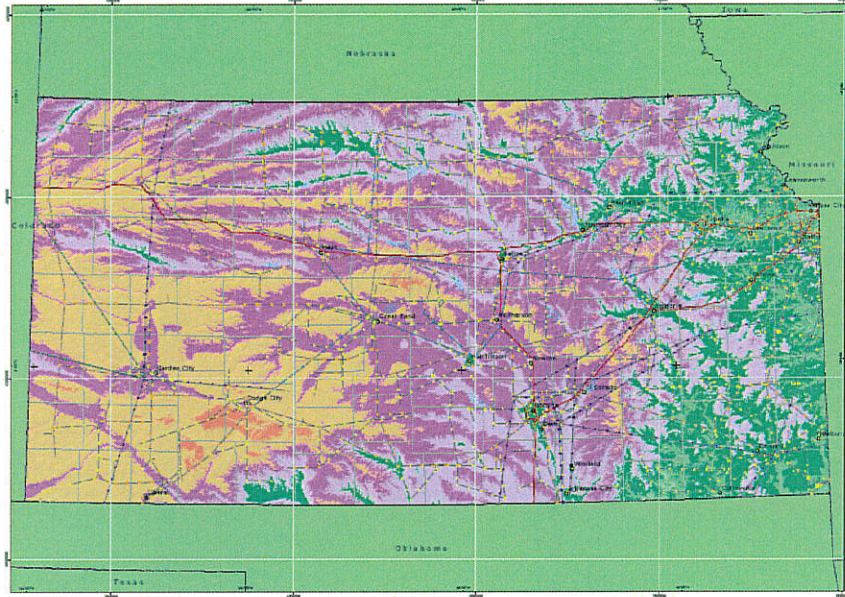
Legend

Mean Annual W.S. (m/s)	W.S. (mph)
< 10.0	< 22
10.0 - 12.5	22 - 28
12.5 - 15.0	28 - 34
15.0 - 17.5	34 - 39
17.5 - 20.0	39 - 45
20.0 - 22.5	45 - 50
22.5 - 25.0	50 - 56
25.0 - 27.5	56 - 61
27.5 - 30.0	61 - 67
30.0 - 32.5	67 - 73

Scale: 0 100 200 Miles / 0 100 200 Kilometers

Originator: AWS Truewind

WIND RESOURCE OF KANSAS Mean Annual Wind Speed at 70 Meters



MESOMAP

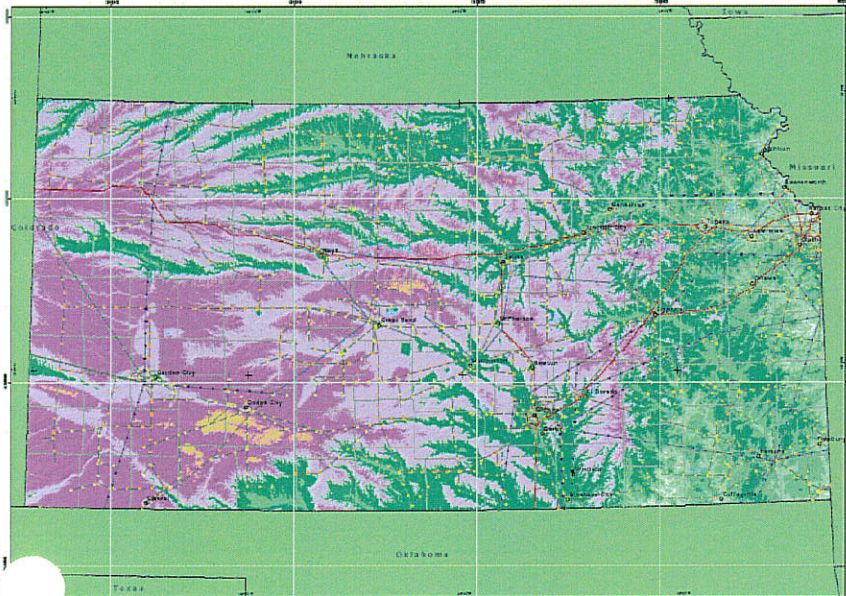
Legend

Mean Annual W.S. (m/s)	W.S. (mph)
< 10.0	< 22
10.0 - 12.5	22 - 28
12.5 - 15.0	28 - 34
15.0 - 17.5	34 - 39
17.5 - 20.0	39 - 45
20.0 - 22.5	45 - 50
22.5 - 25.0	50 - 56
25.0 - 27.5	56 - 61
27.5 - 30.0	61 - 67
30.0 - 32.5	67 - 73

Scale: 0 100 200 Miles / 0 100 200 Kilometers

Originator: AWS Truewind

WIND RESOURCE OF KANSAS Mean Annual Wind Speed at 50 Meters



MESOMAP

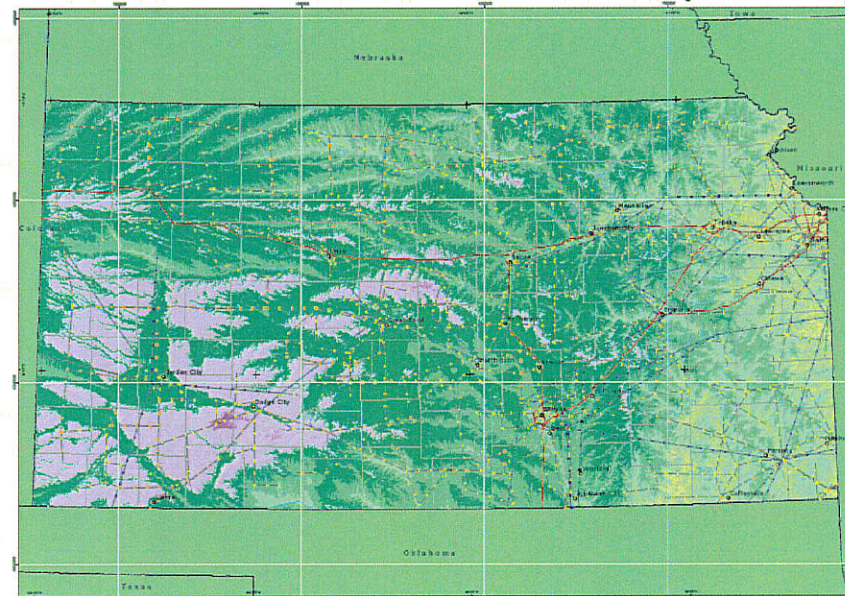
Legend

Mean Annual W.S. (m/s)	W.S. (mph)
< 10.0	< 22
10.0 - 12.5	22 - 28
12.5 - 15.0	28 - 34
15.0 - 17.5	34 - 39
17.5 - 20.0	39 - 45
20.0 - 22.5	45 - 50
22.5 - 25.0	50 - 56
25.0 - 27.5	56 - 61
27.5 - 30.0	61 - 67
30.0 - 32.5	67 - 73

Scale: 0 100 200 Miles / 0 100 200 Kilometers

Originator: AWS Truewind

WIND RESOURCE OF KANSAS Mean Annual Wind Speed at 30 Meters



MESOMAP

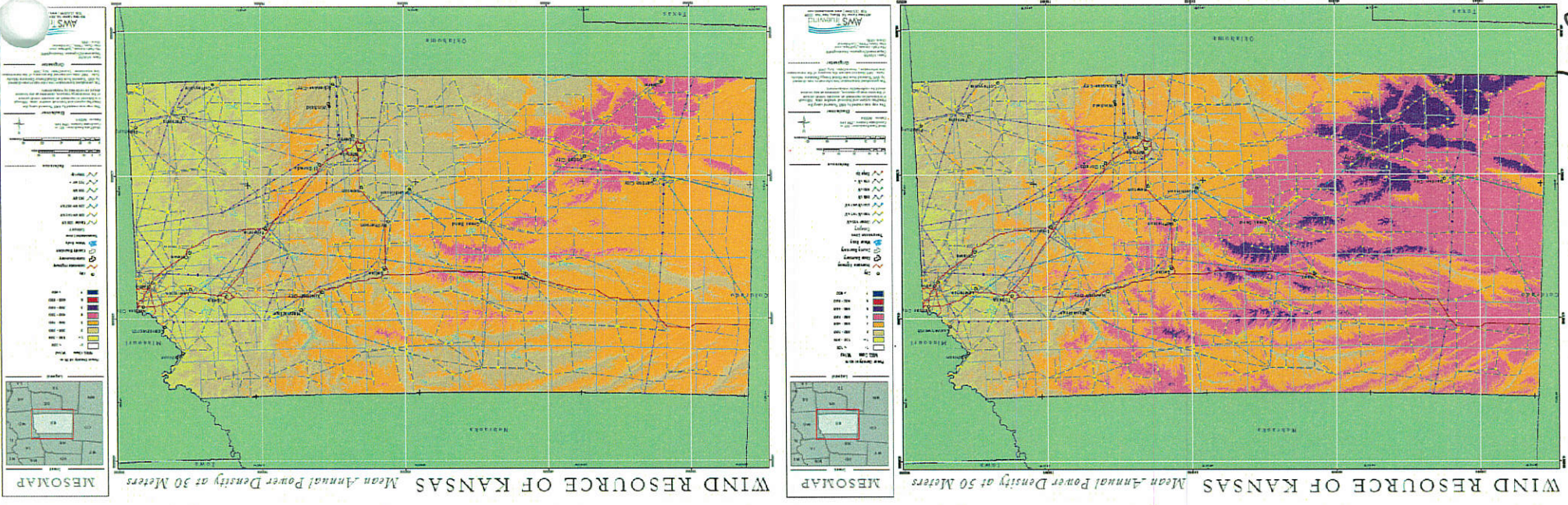
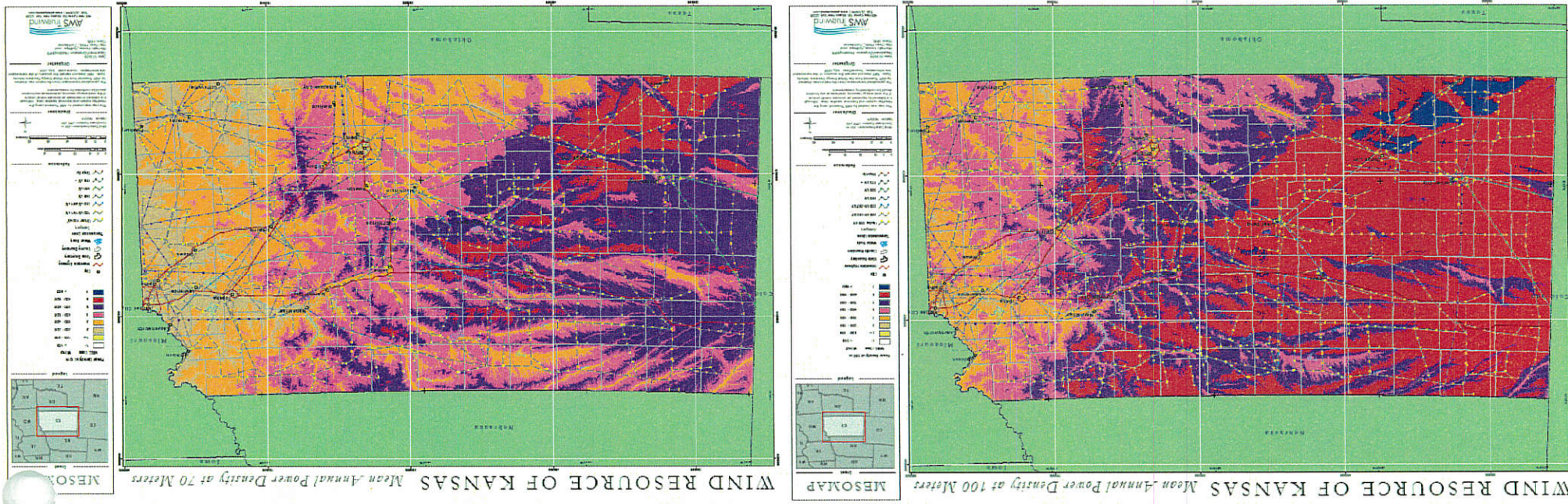
Legend

Mean Annual W.S. (m/s)	W.S. (mph)
< 10.0	< 22
10.0 - 12.5	22 - 28
12.5 - 15.0	28 - 34
15.0 - 17.5	34 - 39
17.5 - 20.0	39 - 45
20.0 - 22.5	45 - 50
22.5 - 25.0	50 - 56
25.0 - 27.5	56 - 61
27.5 - 30.0	61 - 67
30.0 - 32.5	67 - 73

Scale: 0 100 200 Miles / 0 100 200 Kilometers

Originator: AWS Truewind

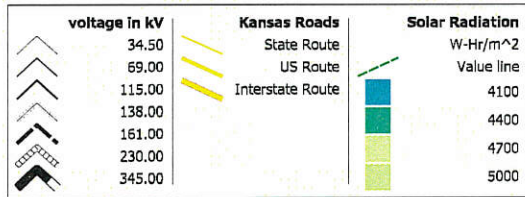
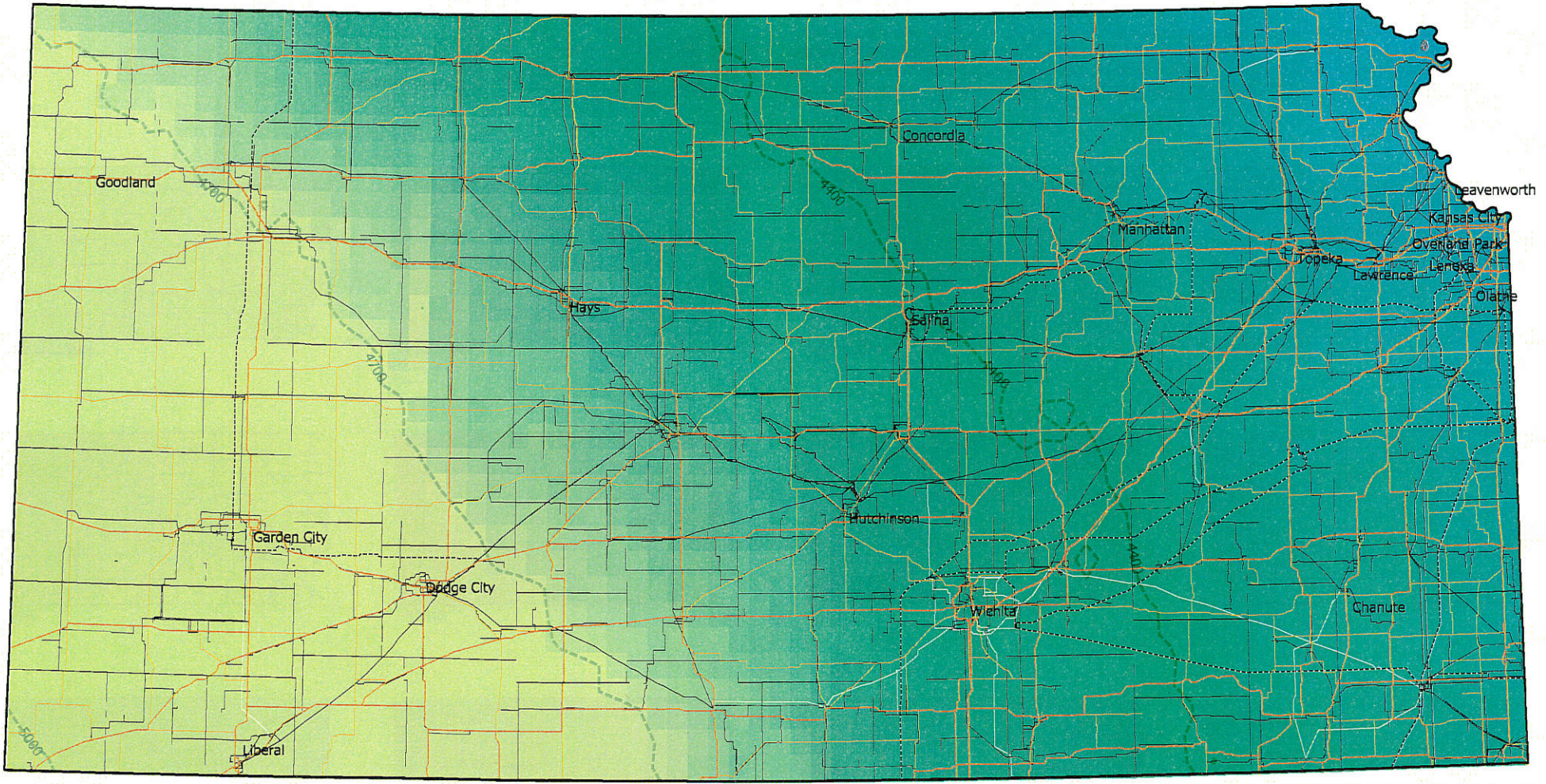
KANSAS WIND RESOURCES - MEAN ANNUAL POWER DENSITY - 100, 70, 50, 30 meters



1-23

1-24

Kansas Solar Resource Map



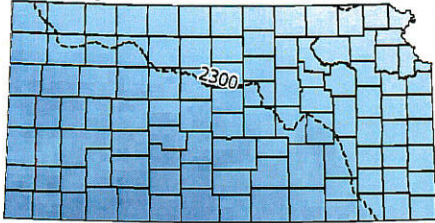
This material was prepared with the support of the U.S. Department of Energy (DOE) Grant No. DE-FG26-07NT43197. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of DOE.



Kansas Solar Resource Map

1-25

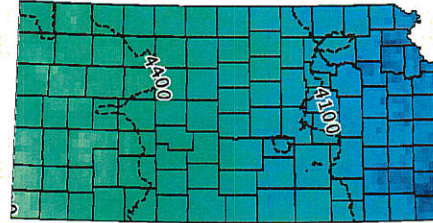
January



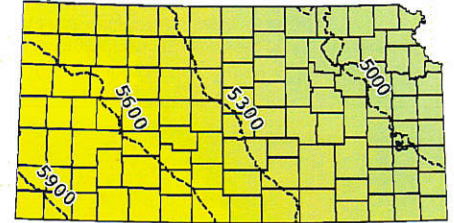
February



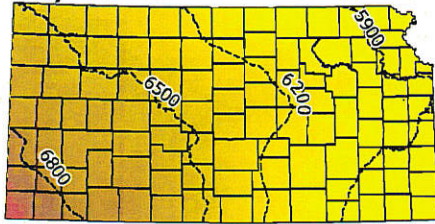
March



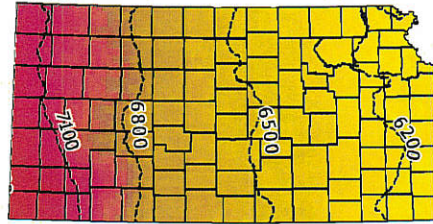
April



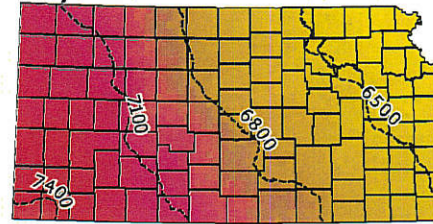
May



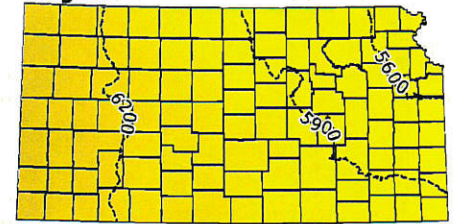
June



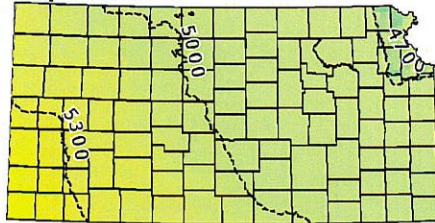
July



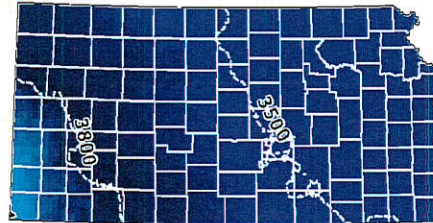
August



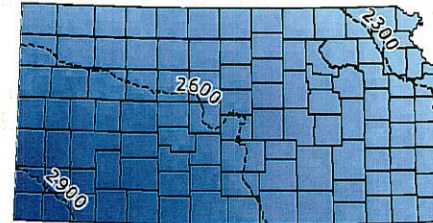
September



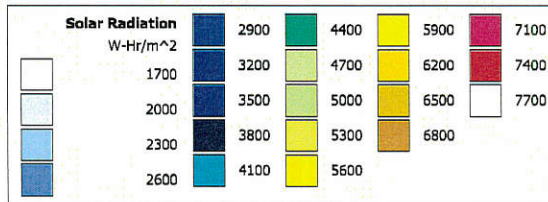
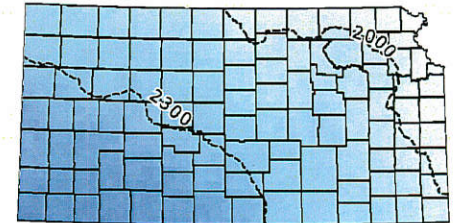
October



November



December



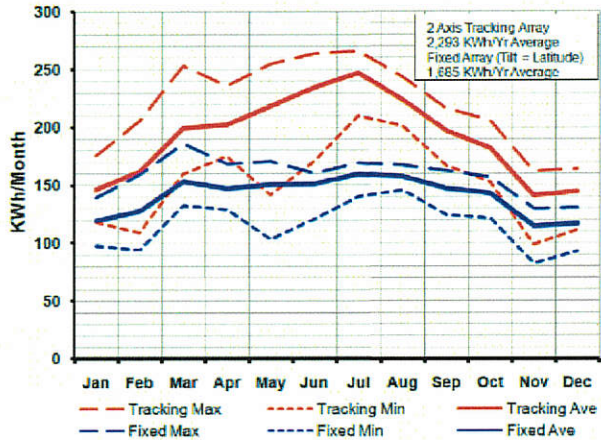
The average annual solar energy falling on one square mile in central Kansas is about four billion KWh or fifteen trillion Btu, the equivalent of two and one-half million barrels of oil. About 70 square miles receive solar energy equal to Kansas's annual energy consumption. Plants using photosynthesis might convert 1% or less of this energy to biomass. Solar thermal systems might convert 30-40% to useful heat, and solar photovoltaic systems might convert 5-20% to high value electricity. Matching the availability of the resource to the demand for energy is an important factor in making solar energy systems feasible, technically and economically. The maps above show monthly solar energy in Watt-hours per square meter for Kansas.



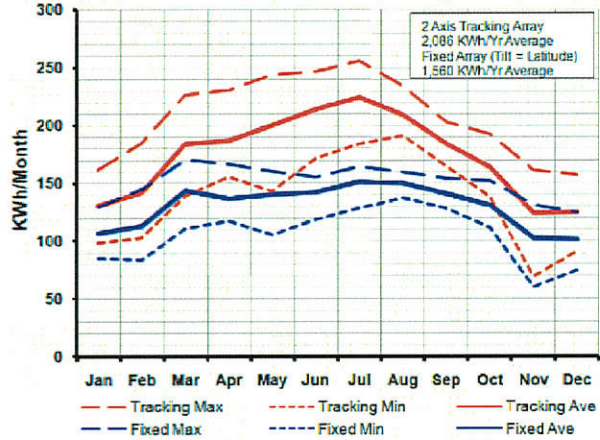
Photovoltaic Electrical Energy Production in Kansas

1991 - 2005 National Solar Radiation Database (NSRDB)

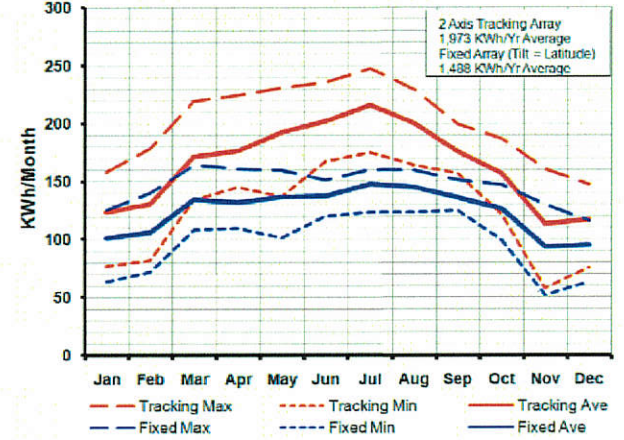
Goodland
1 KW Photovoltaic Array Energy



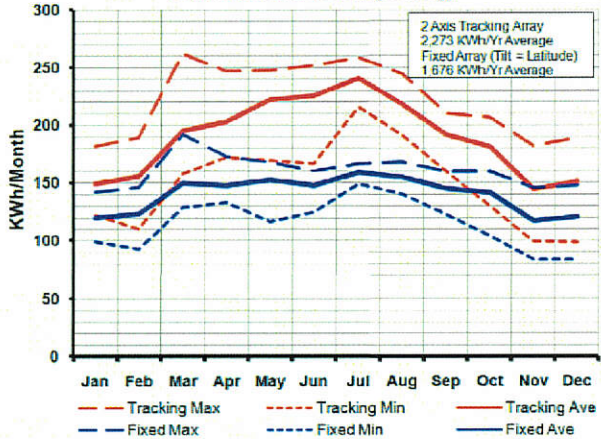
Concordia
1 KW Photovoltaic Array Energy



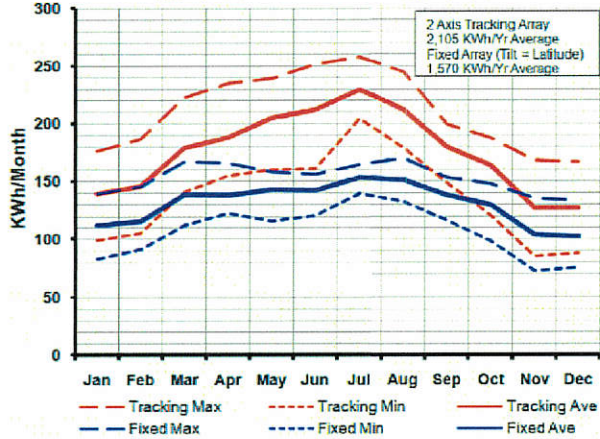
Topeka
1 KW Photovoltaic Array Energy



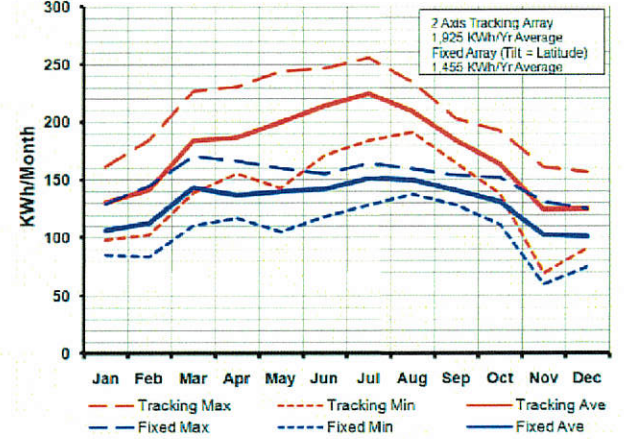
Dodge City
1 KW Photovoltaic Array Energy



Wichita
1 KW Photovoltaic Array Energy



Chanute
1 KW Photovoltaic Array Energy



Photovoltaic (PV) production of electricity is one way to produce high value renewable energy from sunlight (solar insolation). The graphs above show the estimated monthly electricity production from a one kilowatt (KW) PV system for six representative Kansas communities. The analysis was based on 15 years (1991-2005) of hourly solar insolation data contained in the National Solar Radiation Data Base (NSRB) acquired through the National Renewable Energy Laboratory at http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/. The analysis was based on a commonly available PV panels using PV-DesignPro software available from Maui Solar Energy Software Corporation at <http://www.maui-solar.com/>. Inverter losses for converting DC to AC current are included. Other system losses were assumed to be minimal. Maximum, minimum, and long term average values are shown for two panel mounting conditions, one fixed at a tilt equal to the latitude of the site, the second on a two axis tracker that keeps the panels perpendicular to the sun.



North American Cap-and-Trade Initiatives

