Energy Production Options

By: Jonathan Fisk

[Editor's Note: The issue of energy policy in Kansas has been at the forefront of debate in the Kansas Legislature this year. Regardless of the outcome of the particular issue involving the proposed coal plants in western Kansas, we believe that overall issue of a statewide energy policy will be a critical issue for a number of years to come. To that end, we are publishing a series of articles over the next few months which are intended to be informational in nature regarding the issues of production types, transmission, environmental impacts, and energy efficiency. LKM will also be hosting an Energy Summit June 26-27, 2008 in Topeka to provide a forum to continue the discussion on these issues. On Thursday, June 26, we will be bringing in a number of experts in the field to discuss all of these issues. Then, on June 27, the meeting will be limited to LKM members only for a discussion of what, if anything, should be LKM's role in the energy policy debate. Look for more information regarding the Energy Summit in future editions of the Kansas Government Journal.*]*

Hannah Arendt in "Civil Disobedience, Crises of the Republic", observed that "Promises are the uniquely human way of ordering the future, making it predictable and reliable to the extent that this is humanly possible." The promises of new technology, using Arendt's observation, are mankind's way of understanding and securing the future. Currently, a variety of public and private entities are researching and developing new techniques, technologies, and procedures in an attempt to secure America's energy future. If extrapolated 20 or 30 years, these R&D efforts will change America's energy portfolio. It will likely include a diverse set of new and enhanced methods and production techniques, but it will also include traditional fossil fuels.

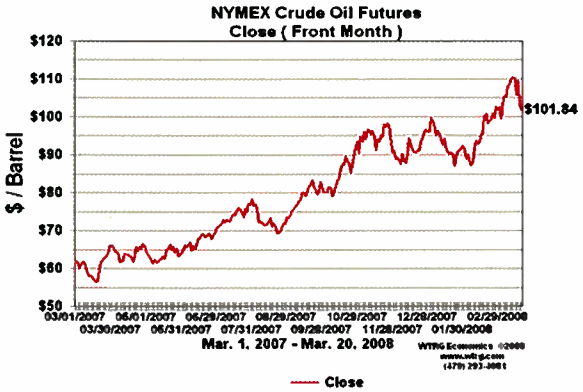
This article addresses multiple energy sources–revamped old and emerging technology. It is not an exhaustive review of all new energy production techniques; however, it attempts to review energy sources that are important to Kansas.

Starch-Based Ethanol

Starch-based ethanol is a renewable, clean-burning energy source. Fundamentally, starch-based ethanol is grain alcohol, produced from corn and other feedstocks. Corn is used as the feedstock for 98% of the ethanol produced in the United States.[1] Because it is produced from plant feedstocks, it has the potential to significantly reduce oil imports. As such, ethanol has enjoyed a long history of government and taxpayer support. For example, taxpayers have subsidized ethanol production for 30 years (beginning in 1978) with the current subsidy at 51¢ per gallon.

The price of oil also impacts the rate of consumption and the popularity of ethanol.

Historically, oil prices (as measured by the U.S. refinery acquisition cost in nominal terms) have been cheap. In fact, a barrel of oil cost between $10 and $30 from 1983 to 2004. In 2004, the crude oil price began its steep climb to around $70 per barrel. In 2008, crude oil crept to more than $100 per barrel. This rapid increase in the crude price and ethanol's fixed subsidy has helped make it tremendously cost competitive with oil and politically popular. As such, ethanol plant construction has boomed in recent years in the Midwest and especially in Kansas.



Source: http://www.wtrg.com/daily/crudeoilprice.html

Kansas Incentives

States are also encouraging the proliferation of ethanol plants and consumption. Kansas, for example, provides the Alternative Fuel Vehicle Tax Credit (AFV), which offers an income tax credit worth up to 40% of the incremental or conversion cost for qualified AFVs placed into service after January 1, 2005. Qualified vehicles run on gasoline produced from grain starch, oil seed, animal fat, or other type of biomass. Kansas has also encouraged ethanol production through the "Kansas Qualified Agricultural Ethyl Alcohol Producer Fund." The fund pays producers to manufacture more ethanol. (K.S.A. 79-34, 163)

Finally, the Kansas Qualified Biodiesel Fuel Producer Incentive Fund provides a production incentive of 30¢ per gallon of biodiesel fuel sold. The biofuel producer must be a qualified dealer. The incentive is payable to producers from the funding which was made available for the production of biodiesel fuel beginning July 1, 2007. (K.S.A. 79-34, 158) In addition, property used predominantly to produce and generate electricity utilizing renewable energy resources or technology is exempt from property taxation pursuant to K.S.A. 79-201.

Federal Incentives

As stated before, the largest federal subsidy for ethanol is its production credit—which stands at 51¢ per gallon. In the 2005 energy bill, Congress increased a biofuel production standard to 7.5 billion gallons by 2012. However, ethanol has strong political support for higher production mandates. In fact, in 2007, President Bush called for increasing the renewable fuel production standard to 35 billion gallons by 2017. Moreover, in the Energy Independence and Security Act of 2007, Congress increased biofuels standard to 9.0 billion gallons by 2008

and 36 billion gallons by 2022.[ii] It should be noted that beginning in 2016, new renewable fuel standards come into effect. In fact, federal law will require that all of the increases in renewable fuel standards must be satisfied with sources other than corn starch.[iii] In addition to providing domestic subsidies, Congress protects American corn growers. Currently, Brazil produces around 4-5 billion gallons of sugarcane-based ethanol at a lower cost than corn-based American ethanol. However, because of a 54¢ per gallon tariff on imported ethanol, most Brazilian ethanol is not sold in the United States.[iv]

Cellulosic Ethanol

According to U.S. Department of Energy (DOE) estimates, even if corn yields increase, corn-based ethanol cannot meet the growing U.S. fossil fuel demand. By 2020, the DOE projects that the United States will consume 15 billion gallons of ethanol annually, which is still not enough to meet forecast demand. Simply put, farmers cannot produce enough corn grain to meet this demand.[v] As such, corn ethanol production is likely to be augmented with other biomass-based fuels.

President Bush recognized the limitations of starch-based ethanol in his 2007 State of the Union speech, when he advocated that cellulosic ethanol should be "practical and competitive" by 2013. Currently, cellulosic ethanol is produced from biomass crops such as prairie grasses, agricultural residues, and wheat straw, among others. Switchgrass has been recognized as an optimal feedstock for cellulosic ethanol. Current research shows that it is more efficient (more biomass per unit area) than most other species and can be harvested once or twice a year.[vi] Moreover, switchgrass-based production emits less greenhouse gases and offers consumers a higher energy balance than other ethanol types. (For the consumer, a higher energy balance means that a gallon of cellulosic ethanol contains more energy than it takes to produce that gallon.) Corn ethanol typically has an energy balance of 1.29:1.65, while cellulosic ethanol's balance is approximately two times higher at 4.4:6.61. It should be noted that cellulosic ethanol's balance does vary because of different feedstocks and methods of production. Therefore, cellulosic ethanol conversion requires more energy to produce, but it contains a greater energy balance compared to corn ethanol.[vii] Finally, switchgrass, because of frequent root turnover and a deep root structure, mitigates the ecological damages caused by soil erosion.[viii] Although cellulosic ethanol possesses many benefits and support, much is still unknown about viability on a commercial scale.

Kansas Incentives

The State of Kansas provides an investment tax credit (K.S.A. 79-230; 66-1,158 *et seq.*)[ix] and exempts property used predominantly to produce and generate electricity utilizing renewable energy resources or technology (K.S.A. 79-201).

Federal Incentives

The federal government passed legislation that encourages research and production of cellulosic ethanol. The 2005 Energy Policy Act of 2005 authorizes a credit-trading program in which 1 gallon of cellulosic biomass ethanol is equivalent to 2.5 gallons of renewable fuel. The Act also creates a goal of producing 250 million gallons in or about 2013. It also guarantees loans of 250 million dollars per ethanol plant. Moreover, the Act encourages new research into cellulosic ethanol. Specifically, the law provides a $650 million grant program and $550 million for an advanced fuels program. Also, the legislation provides a set of incentives to encourage producers to manufacture the first billion gallons of annual production. Finally, the 51¢ per gallon credit also applies to cellulosic ethanol.

Solar Energy

As the sun shines, it emits light energy. Its "reserves" are the "greatest untapped renewable energy source and has the potential to supply the earth's energy needs many times over, if it could be properly harnessed."[x] Simply put, the land area of the United States is 9.161 million sq. km. If this entire area could capture solar energy, it would equal 6,700,000 nuclear power plants.[xi] However, current technology limits the "availability" of solar energy. For example, a solar collection field the size of Pennsylvania and Rhode Island would have to be constructed to supply all of the electricity needs of the United States. Clearly, producing tens of thousands of square miles of photovoltaic (PV) cells is not economically possible. Interestingly, "because U.S. cities and residences cover about 140 million acres of land, the nation's current electricity requirements could be met simply by applying PV to 7% of this area—on roofs, on parking lots, along highway walls, on the sides of buildings, and in other dual-use scenarios."[xii]

Currently, solar energy can be used in primarily two forms. Technology has now made it possible for that energy to be captured and converted into heat and electricity. It can be converted to thermal energy (active) and used to heat domestic and industrial water sources and space heating. Power suppliers can also use photovoltaic (passive) to directly convert solar energy to electricity and used for buildings, etc. For example, many buildings are now able to collect and store solar energy and use it for heating purposes. Finally, it does not emit any greenhouse gases or create negative environmental externalities.

Solar energy is also becoming cheaper and more prolific. In 1980, the cost per watt of solar energy was approximately $25. In 2002, the cost of solar energy had been reduced over 70% to around $5 to $7 per watt.[xiii] In fact in 2006, Boeing-Spectrolab created a concentrator solar cell that achieved a conversion efficiency of 40.7%. As such, the U. S. Department of Energy now estimates that installation costs will likely decrease to $3 per watt or 8-10¢ per kilowatt/hour in the next decade.[xiv] It is becoming economic enough to power providers that they are beginning to design and build solar power plants. Moreover, as the cost of other fossil fuels continues to increase, the relative cost of solar energy will continue to decrease. These trends led the Kansas Corporation Commission to conclude that around 2010 it is likely that grid-connected solar energy will be competitive on the domestic power market.[xv] Concentrating solar power stations (CSP) increase the efficiency of rooftop solar panels.[xvi] CSP plants generate electricity by using mirrors or lenses to concentrate the sun's energy. These plants generally have an energy payback time of less than 6 months, compared to a lifespan of 25 to 30 years.

During the first energy crisis, nine concentrating solar plants (330 MW) were built in California. However, as energy prices decreased and federal support wavered, the solar industry dwindled. Nonetheless, higher energy prices have returned, and so has federal support for solar energy. The first CSP plant, a 64-MW plant in Nevada, is due to become operational in the next few years. In fact, worldwide there are more than 45 CSP projects (5,500 MW) that are being planned.

Kansas Incentives

Solar power is included in the tax exemptions provided by K.S.A. 79-201. Also, Kansas has passed K.S.A. 58-3801, *et seq.* which allows for parties to voluntarily enter into solar easements.

Federal Incentives

Initially scheduled to expire at the end of 2007, the Energy Policy Act of 2005 (H.R. 6, Sec. 1335) established tax incentives for solar power. It should be noted that these incentives had to be extended through December 31, 2008, by Section 206 of the Tax Relief and Health Care Act of 2006 (H.R. 6111). The primary provision establishes a 30% tax credit up to $2,000 for the purchase and installation of residential solar electric and solar water heating property. Also, an individual can take both a 30% credit up to the $2,000 cap for a photovoltaic system and a 30% credit up to a separate $2,000 cap for a solar water heating system."[xvii]

The Energy Tax Incentive Act of 2005, under Title XIII of the Energy Policy Act of 2005, established Clean Energy Renewable Bonds (CERBs). The bonds are a financing mechanism that the public sector may use to fund renewable energy projects. Originally, the Act set aside $800 million that was to be issued between January 1, 2006 and December 31, 2007. However, more than 786 applicants from 40 states applied for a total of $2.5 billion in funding requests.[xviii] The Act provides a second financing option. The Renewable Energy Production Incentive (REPI) offers payments for electricity produced and sold by qualifying facilities. The qualifying producers are eligible for annual incentive payments of 1.5¢ per kilowatt-hour (in 1993 dollars and indexed for inflation) for the first 10-year period of their operation, subject to the availability of annual appropriations in each federal fiscal year of operation."[xix]

Coal

In Kansas, coal generates 74% of the electricity consumed. Forecasters predict that coal will remain one of the main power sources in the state. Additionally, its demand is expected to remain steady through 2010. Also, of note, experts predict that coal plant construction will slow, and it is likely that few (if any) coal plants will add to the nation's baseload capacity before 2010.[xx]

Historically, coal power is inexpensive and dependable. It provides important baseload capacity along with the potential for economic growth in the area where the plant is located. The primary benefit of coal plant development, as presented by its supporters, is economic development and the subsequent economic multiplier effect for the region. Oscar Lange (1947, 227) defined the multiplier effect as "the marginal effect of a change of one economic variable upon another economic variable, of which the first variable is a component; for instance, the marginal effect of a change in primary employment upon total employment, or of a change in investment upon national income."[xxi]

In recent years, due to higher demand and shipping issues, the price of coal has been increasing. In fact, the price has increased as much as 15% in some markets. However, Kansas has few coal reserves and imports the majority of its coal from Wyoming. As such, even though Wyoming has a long-term supply of coal, it currently has a poor distribution rail network.[xxii] In fact, total American reserves are likely to last for the next 200 to 250 years.[xxiii]

Opponents of coal generation claim coal hurts the environment. Coal production accounts for 60% of U.S. sulfur dioxide emissions, one-third of U.S. mercury emissions, and a quarter of U.S. nitrogen oxide emissions. In addition to being non-renewable, coal plants release more than 33% of carbon dioxide (main greenhouse gas). Although Kansas is a small contributor, global coal power generation is responsible for 70% of the 9 billion metric tons of greenhouse gases that are annually released into the atmosphere.[xxiv]

In recent years, technological advances have been designed to mitigate the environmental impact of coal generation. Coal supporters describe "clean coal technology" as the industry's future. This technology reduces air emissions and other pollutants that are associated with coal power. Recent efforts by the Department of Energy towards an emission-free plant have resulted in a FutureGen project. The Department writes that the project would "produce electricity and hydrogen from coal and capture the carbon dioxide that would be generated in the process. The carbon dioxide would be injected thousands of feet underground on site."

Natural Gas

Natural gas has multiple uses. For example, natural gas has industrial, commercial, and residential uses as well as generating electricity. Its most common use is for heating and cooling homes and other buildings. Natural gas trade is increasing on the domestic and international level because it is cleaner than oil and coal and less controversial than nuclear.

Recent industry trends have demonstrated increased interest in natural gas. For example, natural gas pipeline exports grew by 39%, and trading of liquified gas (LNG) grew by 55% between 1995 and 2001. The natural gas industry is predicting that worldwide use of natural gas will increase, especially to generate electricity. In 2001, natural gas occupied 18% of the total energy used to generate electricity. By 2025, it should occupy 25% of the total energy used to generate electricity.

However, electricity from natural gas tends to be more expensive than electricity from other sources. As with other energy types, natural gas prices fluctuate based on supply and demand. Unlike other energy feedstocks, the U.S. natural gas market is regional.[xxv] The price flexibility of natural gas is a result of weather, storage, competition, demand (or seasonal use), and availability.[xxvi] For example, after the 2005 hurricane season, the price of natural gas spiked because supply levels had been reduced. As such, many times with large base-load coal or nuclear plants, natural gas is used to offset peak demand periods, which usually occur in the summer and winter months.[xxvii]

Kansas Wind

The current buzz in many state energy planning bodies is the potential of wind energy. As expected, in 2006, producers added 2,454 MW of wind power to the national grid. Therefore, by the end of 2006, wind power accounted for 11,575 generated MW of electricity.[xxviii] In fact, the United States office of Renewable Energy estimates that the capacity of wind producers has increased approximately 24% per year in the United States since 2000. Currently, Kansas has 364 MW (late 2007) of installed wind capacity. New estimates by the Kansas Corporation Commission place Kansas' wind capacity in development at 1013.4 MW by December 31, 2008. Despite the excitement, both informal and formal barriers remain in areas such as education, infrastructure, and capacity. The efficiency and size of many components to wind production has increased. For example, early in the 1980s, a typical rotor's diameter was approximately 18 to 20 meters and produced only 50kW of electricity, or enough electricity for about

200 homes. Current technology can produce enough power for 1,300 homes.[xxix]

The long list of wind energy benefits provides an understanding for the current level of bipartisan political support. The potential for Kansas' wind energy places it amongst the top three states in the nation. It is at least 10 times greater than the state's current electrical demand.[xxx] Also, a Kansas Corporation Commission benefit-cost analysis showed that if the advantages the state derives from increasing its reliance on clean energy sources (e.g., reduction in healthcare costs associated with air pollution) are factored into the equation, then wind is cost effective in many instances. In fact, since the late 1980s, the cost of wind energy has decreased dramatically and can generate electricity for less than 5¢/kWh in many parts of the United States.

Wind is not a cure all. The short-term costs associated with wind are higher than traditional fuel sources. The KCC benefit-cost analysis indicates that wind energy is still not completely cost effective. The study demonstrated that *additional* wind-generated electricity in Kansas tends to be more expensive than electricity from the state's existing power plants.[xxxi]

Because of its intermittency, wind is not considered "either firm or dispatchable by electric utilities" or by the regional authority, the Southwest Power Pool (SPP). As such, the SPP requires that wind energy be backed up 100% by firm generation (e.g., coal-fired, nuke, gas-fired). One other drawback to wind energy at this time is the lack of sufficient transmission capacity in Kansas that would be required to accommodate large-scale wind development in western Kansas.[xxxii]

Kansas Incentives

Governor Kathleen Sebelius supports the establishment of a renewable portfolio standard. Although a number of utility providers have agreed to a voluntary renewable portfolio standard, Kansas has not yet legislated such a requirement. The Governor has also signed an order creating the Kansas Wind Working Group to further study the issues surrounding the development of wind energy in Kansas.

As a specific incentive, Kansas currently offers the Kansas Parallel Electric Generation Services Act. (K.S.A. 66-1184). It should be noted that this is Kansas' equivalent to net metering. Net metering offers customers the option to offset their energy costs by selling electric power back to the utility. In essence, a customer's electric meter can run both forward and backward in a metering period and the customer will only be charged for the net amount of power used. True net metering requires the utility to purchase power back at the retail rate and use one meter.

K.S.A. 79-201 also applies and exempts renewable energy equipment from property taxes. Finally, the state does provide grants to developers. Indirectly, incentives such the accelerated cost recovery schedule, a sales tax exemption on certain property [K.S.A. 79-3606(cc)], and the job creation tax credit [K.S.A. 79-32,160a] may benefit the producers of a wind project.

Federal Incentives

The Federal Production Tax Credit is the main federal incentive for wind. This tax credit is now 2¢ per kilowatt-hour and is available for the first 10 years of the project. For example, a 1.5 MW wind turbine can qualify for as much as $90,000 per year in production tax credits.[xxxiii] It should be noted that this credit expires December, 31 2008 and the future development of wind generation projects will depend largely upon whether the federal government renews this credit or allows it to expire. CERB bonds and REPI programs also apply to the development of wind projects.

Nuclear

Currently, Kansas is home to one nuclear plant. The Wolf Creek plant produces enough electricity to power up to 800,000 homes and accounts for 19% of Kansas' electrical needs. In fact, it does so without creating any more radiation than is found in the natural environment.[xxxiv]

The Wolf Creek plant is a significant economic driver in Coffey County and the state. It is responsible for $7.9 million of the county's economic output (not including the cost of electricity) and $79.9 million of the state's output in 2003. Indirectly and directly, the plant pays nearly $30 million in state and local taxes. The plant employs 1,028 people and through the multiplier effect creates an additional 121 jobs in the county. Finally, in 2004, the cost of production was 1.44¢ per kilowatt-hour, which was .25¢ per kilowatt-hour less than the region's average cost.[xxxv]

The nuclear industry is undergoing a renaissance. Slowly, the public and policymakers are becoming supportive of new nuclear construction. In fact, in 2007 NRG Energy, a New Jersey producer submitted the first complete construction and operating license application for a new 5.4 billion dollar U.S. nuclear facility since 1979. Currently, the United States has 104 nuclear facilities. Yet, by the end of 2008, the Nuclear Regulatory Commission estimates that it will receive applications for 30 new plants (at a combined construction cost of $90 billion).

Nuclear plants tend to be capital intensive. Although nuclear plants involve high fixed costs, mostly during construction, they also have low operational costs and add to the company's baseline power production. The attractiveness of nuclear power is also impacted by the uncertainty of coal regulation, the price volatility of oil and natural gas and the weak reliability of wind and solar.

According to the Kansas Sierra Club, the Nuclear Industry and its supporters hide the true costs of nuclear power. They explain that while the demand for uranium increases, the supply has not, leading to higher uranium prices. Moreover, nuclear power advocates do not include $75 billion in subsidies (enrichment and liability insurance) that the industry has received. Finally, taxpayers will also likely pay at least $33 billion to de-commission expired plants. In fact, a 2003 M.I.T. study concluded that light-water reactor generated electricity costs $0.067 per kWh (no subsidies included). The figure is double the price of wind-generated power.[xxxvi]

An expansion of nuclear plants would create an enormous amount of new nuclear waste that must be safely stored for up to 250,000 years. According to the Sierra Club, these costs are also not included in current cost estimates. Alarmingly, the renewed interest in nuclear power has occurred without a concrete waste management plan. Consider that each 1000 MW nuclear reactor produces about 33 tons of nuclear waste annually and that the 103 US nuclear plants already produce 80,000 tons of radioactive waste that is waiting to be shipped to a storage facility.

Kansas Incentives

In an attempt to encourage the expansion of nuclear power generation in Kansas, the Legislature in 2007 authorized certain tax exemptions for such development. See K.S.A. 79-230 and 66-1,158 *et seq.* However, at this time, no company has requested approval of the KCC on any nuclear power plant projects.

Federal Incentives

The most direct nuclear incentive provided

by the Energy Policy Act is a 1.8¢ per kilowatt-hour tax credit for up to 6,000 megawatts of new nuclear capacity for the first eight years of operation. The qualifying reactor must be in service by 2021.[xxxvii] The DOE also provides "Standby Support" financing, which covers the replacement power costs (principal and interest) that are incurred as a result of licensing delays. The report also noted that "important to potential borrowers is the percentage of project costs that can be covered by the DOE loan guarantees. Although EPACT Section 1702(c) allows DOE to "provide loan guarantees for up to 80% of a project's estimated cost, DOE's Guidelines for the initial solicitation 'expresses a preference' that the loan guarantees up to 80% of a project's debt." Finally, the federal government has provided a cap on liability claims in case of a meltdown or other disaster.

Waste to Energy

In a relatively new development, waste management has become a mechanism to realistically produce clean and renewable electricity while also beginning the task of cleaning the environment. The Waste to Energy Research (WTE) and Technology Council at Columbia University explains that a WTE plant operates by separating the non-recyclable fraction of municipal solid waste (MSW) from the recyclable waste. The non-recyclable waste such as food scraps and yard waste is combusted to generate electricity. Such a program, according to the Council, reduces the need for fossil fuels. Consider that one ton of MSW is equivalent to one-third of a ton of coal or one barrel of oil. Even the non-combustible is used in new landfill-management techniques. Finally, the plants use a multifaceted air pollution control system to capture its emissions.[xxxviii] The Integrated Waste Services Association states that 89 WTE plants are able to covert 90,000 tons of trash each day into enough baseload electricity to power approximately 2.3 million homes. Moreover, WTE plants generated 17 billion kWh of electricity.[xxxix]

Landfill gas recovery is also becoming more widespread. According to the Department of Energy, organic material comprises a significant portion of MSW. In a landfill, the waste decomposes and as a byproduct produces carbon dioxide and methane. The carbon dioxide releases into the atmosphere; the methane, however is recoverable. As such, landfill gas recovery operations capture the methane and use it for energy generation.[xl] The C40 Climate Leadership Group designated the Keele Valley facility as a "best practice city." The site served as Toronto's main landfill until 2003. Currently, Eastern Power Developers uses landfill-recovery techniques to produce enough power for about 24,000 homes. It uses approximately 1.8 million tons of methane annually which would have otherwise released into the atmosphere. As such, the city has reduced its fossil fuel dependency and prevented 149,000 tons in C02 emissions and saved nearly $3 million.[xli]

About the Author

Jonathan Fisk is an MPA Management Intern with the League of Kansas Municipalities (LKM). He can be reached at jfisk@lkm.org or (785) 354-9565. Also contributing to this article was Kimberly Winn, the Director of Policy Development & Communications for LKM. She can be reached at kwinn@lkm.org or (785) 354-9565.

i Yacobucci, Brent and Randy Schnepf. U.S. Congress. Congressional Research Service. "Selected Issues Related to an Expansion of the Renewable Fuel Standard (RFS). Dec. 3, 2007. Accessed Jan 10, 2008. http://opencrs.com/getfile.php?rid=62361

ii Sissine, Fred. U.S. Congress. Congressional Research Service. Energy Independence and Security Act of 2007: A Summary of Major Provisions. Dec. 21, 2007. Accessed Jan 15. 2008. http://opencrs.com/getfile.php?rid=62496

iii Sissine.

iv Johnson, Robbin S., and C. Ford Runge. "Ethanol: train wreck ahead? Government policy is stoking unsustainable growth of the corn-based fuel. A more sober, diversified approach is needed. (PERSPECTIVES)." Issues in Science and Technology 24.1 (Fall 2007): 25(6). Expanded Academic ASAP. Gale. University of Kansas Libraries. 2 Jan. 2008 <http://find.galegroup.com.www2.lib.ku.edu:2048/itx/start.do?prodId=EAIM>.

v http://www.ethanolkansas.com/_images/eUpdateFeb16%2007.pdf

vi Laura Bies (2006). "The Biofuels Explosion: Is Green Energy Good for Wildlife?" Wildlife Society Bulletin, *34*(4), 1203-1205 at 1204. Retrieved December 14, 2007, from Research Library database. (Document ID: 1187109351).

vii Bies at 1204.

viii http://kec.kansas.gov/reports/Cellulosic_Ethanol_FINAL.pdf

ix Kansas Department of Revenue. Cellulosic Alcohol Plant Credit. Form K-79. Online at < http://www.ksrevenue.org/pdf/forms/k-79.pdf>

x http://www.engext.ksu.edu/ees/renewables/solar.html

xi Rath, B B, & Marder, J. (May 2007). Power from sunlight: photovoltaics; capturing the vast amount of energy in sunlight is both a cost and a materials challenge for development of cost-effective photovoltaics. (POWERING THE FUTURE). *Advanced Materials & Processes*, 165, 5. p.62(3). Retrieved December 14, 2007, from Expanded Academic ASAP via Gale: http://find.galegroup.com.www2.lib.ku.edu:2048/itx/start.do?prodId=EAIM

xii http://kec.kansas.gov/reports/KSEnergyReport2005.pdf

xiii http://www.kcc.state.ks.us/energy/solar_manual.pdf

xiv http://www.energy.gov/news/4503.htm

xv http://www.kcc.state.ks.us/energy/solar_manual.pdf

xvi See Rath

xvii http://www.seia.org/getpdf.php?iid=21

xviii http://www.dsireusa.org/library/includes/incentivesearch.cfm?Incentive_Code=US45F&Search=Technology&techno=all_solar&currentpageid=2&EE=0&RE=1

xix http://www.dsireusa.org/library/includes/incentivesearch.cfm?Incentive_Code=US33F&Search=Technology&techno=all_solar&currentpageid=2&EE=0&RE=1

xx http://kec.kansas.gov/reports/KEC_EnergyReport2006.pdf

xxi Lange, Oscar. "The Theory of the Multiplier." *Econometrica*, Vol. 11, No. 3/4. (Jul. - Oct., 1943), pp. 227-245. University of Kansas Libraries. Lawrence, KS. 26 Nov. 2007.

xxii http://kec.kansas.gov/reports/KEC_EnergyReport2006.pdf

xxiii http://kec.kansas.gov/reports/KEC_EnergyReport2007.pdf

xxiv http://kec.kansas.gov/reports/KEC_EnergyReport2007.pdf

xxv http://www.federalreserve.gov/BoardDocs/testimony/2003/20030610/default.htm

xxvi http://www.oxfordenergy.org/pdfs/NG18.pdf at 3

xxvii Balat, Mustafa, "Status of Fossil Energy Resources: A Global Perspective." Energy Sources Part B: Economics, Planning & Policy. 2.1(Jan 2007): 31 (17). University of Kansas Libraries. EBSCOhost Academic Premier [Database Online]. Accessed January 10, 2008.

xxviii Annual Report on U.S. Wind Power Installation, Cost, and Performance

xxix Kelly, Marguerite. National Renewable Energy Laboratory, "Wind Energy and Economic Development." June 8, 2007.

xxx http://kec.kansas.gov/reports/KSEnergyReport2005.pdf.

xxxi Kansas Energy Council. http://kec.kansas.gov/energy_plan/07Plan-Ch6-Section6_1.pdf

xxxii Kansas Energy Council. http://kec.kansas.gov/energy_plan/07Plan-Ch6-Section6_1.pdf

xxxiii Kansas Energy Council. http://kec.kansas.gov/reports/Community_Wind_Incentives_July07.pdf

xxxiv http://www.cjonline.com/stories/102807/kan_212916832.shtml

xxxv http://www.nei.org/filefolder/economic_benefits_wolf_creek.pdf

xxxvi http://kansas.sierraclub.org/Planet/2007-0405/NuclearProblems.pdf

xxxvii Parker, Larry and Mark Holt. United States Congress. Congressional Research Service. "Nuclear Power: An Outlook for New U.S. Reactors." Mar. 9, 2007. Accessed Feb. 20. 2008. http://www.fas.org/sgp/crs/misc/RL33442.pdf

xxxviii http://www.seas.columbia.edu/earth/wtert/sofos/WTERT_Brochure_2006.pdf

xxxix http://www.wte.org/energy/

xl http://www1.eere.energy.gov/femp/newsevents/fempfocus_article.cfm/news_id=7364

xli http://www.c40cities.org/bestpractices/waste/toronto_organic.jsp