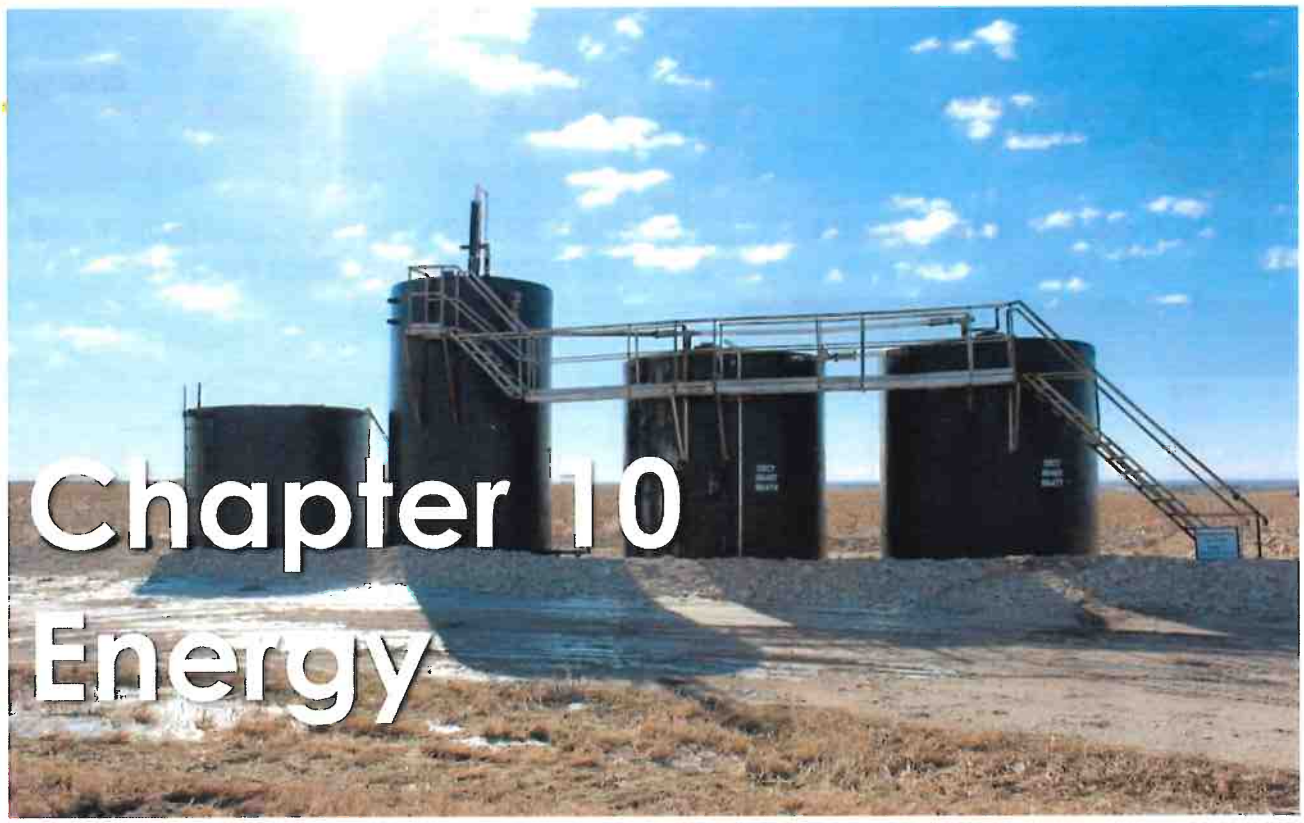


Chapter 10
Energy

Introduction

Energy usage in the early 21st Century is becoming a critical issue throughout Kansas as well as the entire United States. Our dependency on non-renewable energy sources has increased significantly over the past 100 years.

Energy consumption comes in several forms, such as:

- Lighting our homes, businesses, and industries;
- Cooling and heating our homes, businesses, and industries;
- Heating our water for homes, businesses, and industries;
- Food preparation;
- Transportation – both personal and business related;
- Agricultural equipment, and
- Recreation and Entertainment – vehicular, computers, music, etc.

The 21st Century has ushered in an increased concern for energy usage and its impacts on the environment. This increased concern for the environment created a better understanding of the carbon footprint generated by any one individual as well as striving towards modifying our behavior patterns in order to lessen the footprint. In addition, the phrase and concept of sustainability has become more widely used, even in Kansas.

Energy in Ellis County refers to both the oil and natural gas industry as well as the renewable energy industry. Energy is a critical asset in Ellis County.

Oil and Natural Gas in Ellis County

Oil and natural gas production has a solid history in Ellis County. Within the county, as of 2018, there are a total of 2,592 registered oil wells, which down from a recent peak of 2,737 wells in 1995. Table 10.1 shows the number of wells and production per year between 1995 and 2018.

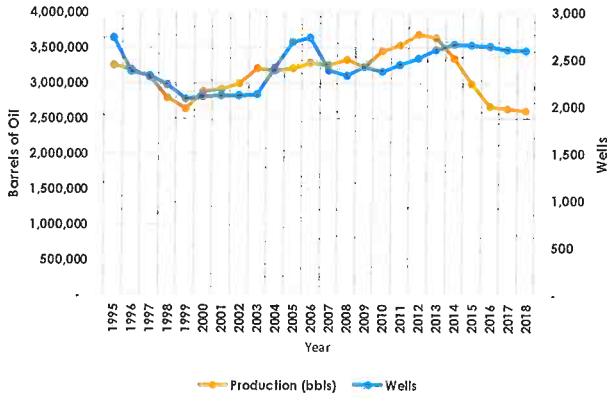
Between 1995 and 2018, the oil production in Ellis County has been up and down ranging from a high of 3,697,452 barrels in 2012 to a low of 2,600,442 barrels in 2018. However, even with the lowest production being in the previous few years, Ellis County is still the highest producing county in Kansas. Figure 10.1 compares the county's oil production in barrels vs. the number of wells in production. There does not appear to be any normal correlation between the number of active wells and the number of barrels produced in any given year.

Table 10.1: Oil Production by Year Ellis County, Kansas

Year	Wells	Production (bbls)	Average Price per Barrel (OPEC)
1995	2,737	3,265,183	$ 16.86
1996	2,369	3,201,877	$ 20.29
1997	2,329	3,093,540	$ 18.86
1998	2,239	2,794,569	$ 12.28
1999	2,079	2,638,315	$ 17.44
2000	2,107	2,888,828	$ 27.60
2001	2,122	2,923,985	$ 23.12
2002	2,114	3,000,470	$ 24.36
2003	2,131	3,216,907	$ 28.10
2004	2,406	3,186,928	$ 36.05
2005	2,694	3,219,529	$ 50.59
2006	2,729	3,292,234	$ 61.00
2007	2,385	3,264,109	$ 69.04
2008	2,328	3,335,989	$ 94.10
2009	2,417	3,226,675	$ 60.86
2010	2,374	3,454,775	$ 77.38
2011	2,443	3,539,796	$ 107.46
2012	2,516	3,697,452	$ 109.45
2013	2,606	3,645,422	$ 105.87
2014	2,666	3,345,907	$ 96.29
2015	2,655	2,992,705	$ 49.49
2016	2,645	2,676,855	$ 40.68
2017	2,603	2,643,019	$ 52.51
2018	2,592	2,600,442	$ 69.52

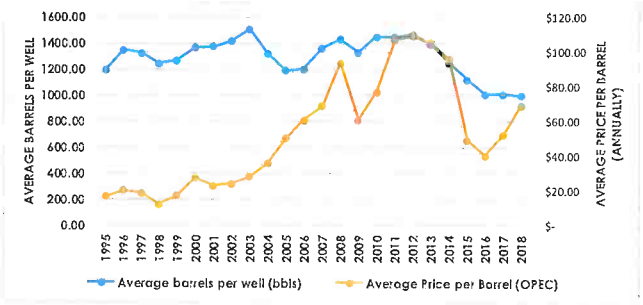
Source: Kansas Geological Survey and https://www.statista.com/statistics/262858/change-in-opec-crude-oil-prices-since-1960/

Figure 10.1: Oil Production by Year



Source: Kansas Geological Survey

Figure 10.2: Oil Production-Average Barrels Per Year vs. Average Price Per Barrel Ellis County, Kansas



Source: Kansas Geological Survey and https://www.statista.com/statistics/262858/change-in-opec-crude-oil-prices-since-1960/

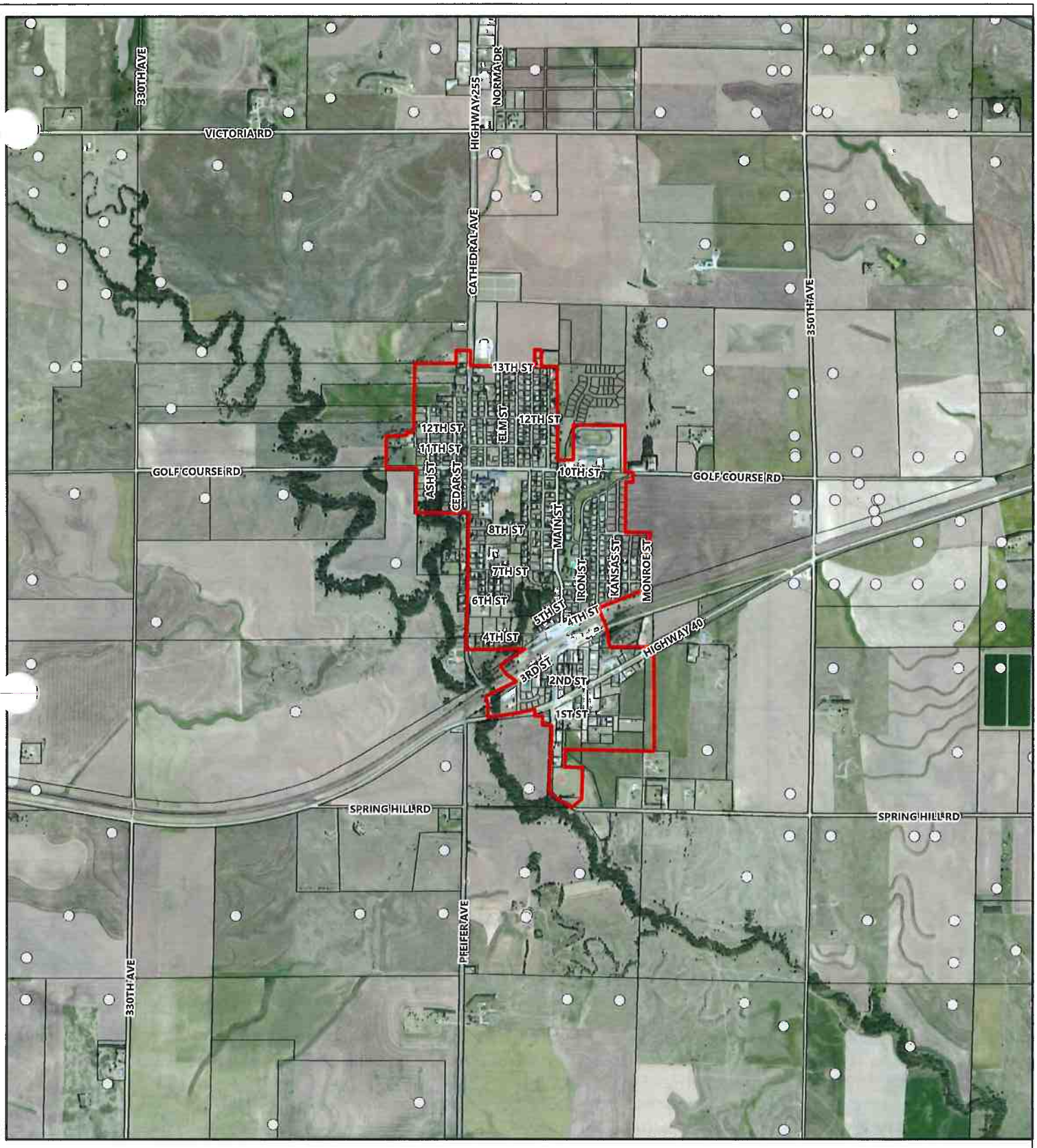
Figure 10.2 examines the average barrels of oil produced by each well and compares production to the average price per barrel (based on the OPEC prices). Again the correlation does not indicate the price per barrel had much influence on the local production of crude oil.

Based upon data from the US Census Bureau's County Business Patterns reports, Annual Payroll in the area of Mining, quarrying, and oil and gas extraction between 2011 and 2016 has been up and down. (Note: due to suppressed data on oil and gas extraction only, the best available data is combined with mining and quarrying).

Table 10.2: Annual Payroll - Mining, Quarrying and Oil and Gas Extraction Ellis County, Kansas 2010 through 2016

Year	Number of Establishment	Annual Payroll
2010	70	$27,405,000
2011	69	$29,000,000
2012	74	$32,441,000
2013	75	$33,733,000
2014	81	$38,079,000
2015	76	$23,000,000
2016	72	$18,306,000

Source: US Census



Legend

- Oil & Gas Wells
- Parcel
- Victoria City Limits

Figure X.X - Oil & Gas Well Locations
Comprehnesive Plan
Victoria, Kansas

PROJECTION: UTM Zone 14N
DATUM: NAD 83
DATE: 05.26.2020

N

0 1,000 2,000 4,000 Feet

Table 10.2 indicates the peak number of establishments reporting annual payroll was 81 in 2014; the low was in 2011 with 69 establishments. The annual payroll began at $29,000,000 in 2011 and peaked in 2014 with $38,079,000. After 2014, the annual payroll declined to a low of $18,306,000 in 2016.

Table 10.3: Natural Gas Production by Year Ellis County, Kansas

Year	Wells	Production (mcf)	Average per well (mcf)
1995	1	87,408	87408.00
1996	1	51,052	51052.00
1997	1	21,903	21903.00
1998	1	8,759	8759.00
1999	1	7,906	7906.00
2000	1	3,935	3935.00
2001	1	3,589	3589.00
2002	1	3,601	3601.00
2003	2	6,619	3309.50
2004	2	4,668	2334.00
2005	2	2,894	1447.00
2006	4	2,962	740.50
2007	-	-	-
2008	2	259	129.50
2009	-	-	-
2010	-	-	-
2011	-	-	-
2012	-	-	-
2013	-	-	-
2014	-	-	-
2015	-	-	-
2016	-	-	-
2017	-	-	-
2018	-	-	-

Source: Kansas Geological Survey

Natural gas production, based upon the Kansas Geological Survey has completely fallen off. Table 10.3 shows the annual production of natural gas, similar to oil production for Ellis County. Based upon the data found, there has not been any natural gas production in Ellis County since 2008.

Renewable Energy

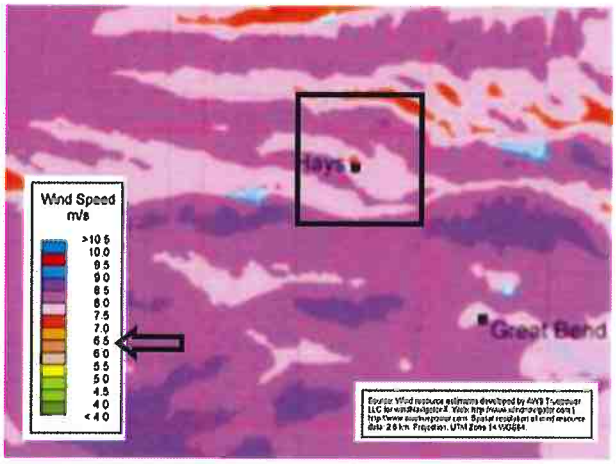
Renewable energy sources, according to most definitions, include natural resources such as the wind, the sun, water, and the earth (geothermal) that can be used over and over again with minimal or no depletion, as well as tapping into sources of methane (from natural resources or man-made conditions). The most common sources of renewable energy used in Kansas are the wind, the sun, water, and earth. The following are examples of how these renewable resources can be used to diversify the county's energy portfolio.

Wind

The wind is one of those resources in abundance in Kansas. Wind is not a new technology in Kansas; the pioneers that settled in Kansas used wind mills for power and to work the water wells on their farms and ranches.

Wind can be used to produce electricity through the construction of small-scale or utility/ commercial grade wind conversion systems (wind turbines). However, not all areas of the state have the ideal levels needed to produce electricity on a utility or commercial level; but the use of small-scale wind turbines on homes and businesses will work in most parts of Kansas.

Figure 10.5: Annual Average Wind Speed @ 80 Meters



According to the US Department of Energy's Office of Energy Efficiency & Renewable Energy, "*Areas with annual average wind speeds around 6.5 meters per second and greater at 80-m height are generally considered to have a resource suitable for wind development. Utility-scale, land-based wind turbines are typically installed between 80- and 100-m high although tower heights for new installations are increasing—up to*

140 m—to gain access to better wind resources higher aloft."

As shown in Figure 10.5, a majority of Ellis County receives at least 7.5 meters per second of annual wind speeds when measured at 80 meters aloft. Therefore, Ellis County, like much of western Kansas, is suitable for wind energy generation.

Photograph 10.1
Photo of an old wind mill

Photograph 10.2
Photo of Buckeye Wind Farm

Ellis County in recent years has become a solid player in wind energy, with the development of the Buckeye Wind Farm. Based upon an article in the Hays Daily News on November 26, 2013, the wind farm is a 200 mega-watt operation developed by Invenergy.
The project spreads out over 28,000 acres of land north of Hays.

In addition, Fort Hays State University utilizes two dedicated wind turbines to assist in powering the campus.

The turbines are provided by Vestas, the leader in producing wind turbines. They have over 47,000 units installed worldwide. PNE Corporation of Longview, Wash., covered installation of the turbines. The turbines stand 400 feet tall and are visible from campus. They were constructed on property located near the intersection of 210th Avenue and Golf Course Road in Hays.

FHSU researched and took steps to ensure the wind turbine generators will not negatively impact the environment or cause an inconvenience to people living near the turbines. Three different evaluations were conducted to measure the effect the two wind turbines might have on the surrounding areas. The first, measuring noise level, determined that "only at the WTG sites does it rise above the level of background noise." A second test measured a shadow flicker effect, and the third examined the aesthetic effects on surrounding landscape. The study determined "some part of the wind turbine will be visible in almost all parts of the area directly adjacent to the installation with a diminishing visual impact as distance increases."

According to documentation submitted to Ellis County, the turbines will provide energy directly to campus, and their combined energy output will cover roughly 97% of energy consumption on campus. This translates to an annual reduction of $600,000 to $1 million in energy costs for FHSU.
Source: https://www.fhsu.edu/president/wind-energy/

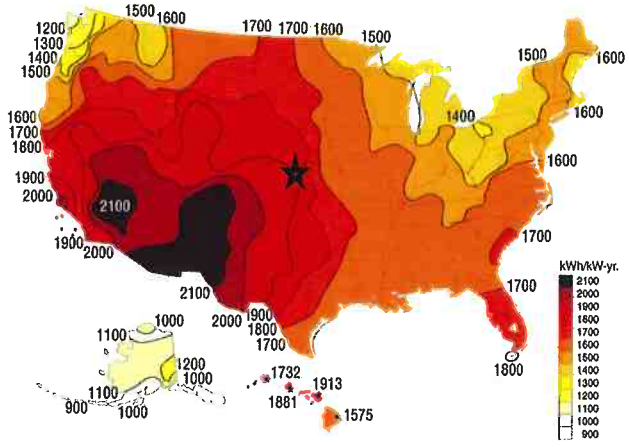
SOLAR

Solar energy has been around for decades and it last hit a high in popularity in the 1970's. However, today's solar energy design is much more efficient and aesthetically pleasing. Some of the aesthetic improvements have to do with the fact that today's systems are not as bulky as their ancestors. Today, solar is being used much like wind turbines, on a small-scale level (home or business) or a much grander level (solar farms).
Solar energy includes solar water and space

heating as well as taking solar photovoltaic panels to convert the sun's rays into electricity. Solar costs, at the time of this plan, have been seeing dramatic cost decreases per kW. Solar is rapidly becoming much more affordable to install and use.

According to the Solar Energy Industries Association, there is great potential for solar generation in Ellis County as a majority of the county and the state lies within some of the better areas in the country for solar potential.

FIGURE 10.6: SOLAR POTENTIAL ELLIS COUNTY, KANSAS



Source: Solar Energy Industries Association

In the future, it may become desirable for new subdivisions/developments to incorporate dedicated renewable energy systems such as solar and wind. In order for this to occur, a standard subdivision regulation and zoning code would likely need to be modified in order to allow these systems.

Commercial solar provides opportunities for agricultural producers through the development of solar farms on lands with low to marginal production capacity. Instead of leaving land unfarmed, producers could work with energy developers to build new facilities.

Photograph 10.3
Photo of Small scale Solar Farm

GEOTHERMAL ENERGY

Geothermal energy is typically utilized through a process where a series of pipes are lowered into vertical cores called heat-sink wells. The pipes carry a highly conductive fluid that either is heated or cooled by the constant temperature of the ground. The resulting heat exchange is then transferred back into the heating and cooling system of a home or other structure. This is called a geothermal heat exchange system or ground source heat pump. The California Energy Commission estimates the costs of a geothermal system can earn net savings immediately when financed as part of a 30-year mortgage *(Source: American Planning Association, PAS Memo January/February 2009)*.

METHANE ENERGY

The use of methane to generate electricity is becoming more cost-effective across the country. Methane electrical generation can be accomplished through the use of a methane digester which takes the raw gas, naturally generated from some form of decomposing material, and converts the gas into electrical power.

There have been some attempts to take the methane generated from animal manure and convert it into electricity; most have been successful but were costly to develop. Another approach to methane electrical generation is to tap into the methane being generated from a

solid waste landfill; instead of burning off the methane, it can be piped into a methane convertor and generated into electricity for operating a manufacturing plant or placed on the overall grid for distribution.

Methane convertors make use of unwanted gases and are able to produce a viable product. As long as humans need to throw garbage into a landfill or the production of livestock is required, there will be a source of methane to tap for electrical generation.

Energy Goals and Policies