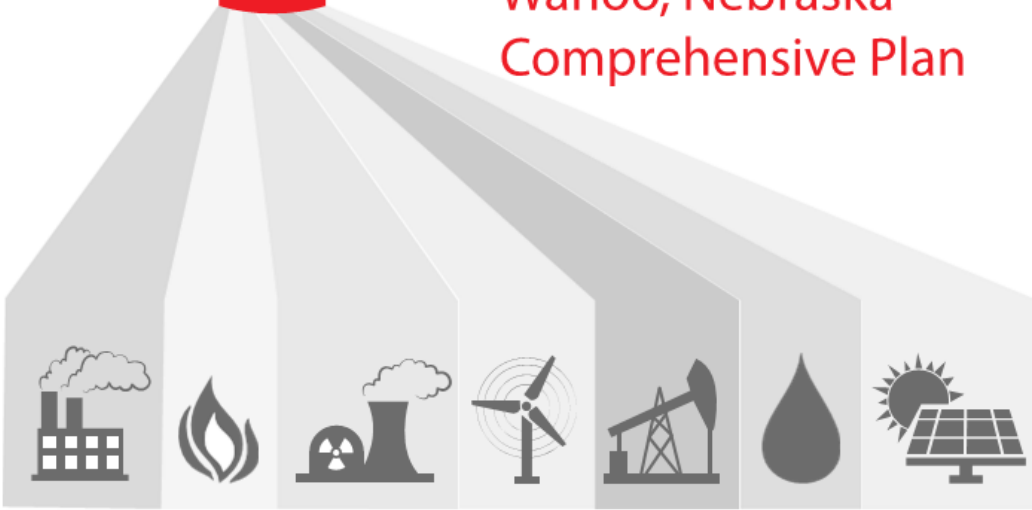




2015 Energy Element

Wahoo, Nebraska

Comprehensive Plan



Adopted: December 23, 2014

Ordinance No. 2169



Contents

Introduction 2

Acknowledgements..... 2

Nebraska Energy Policy Overview..... 2

Energy Infrastructure 4

Energy Use 5

Nebraska Energy Statistics 5

Opportunities for Energy Conservation 8

Opportunities for Renewable Energy 9

Education 13

Funding 13

Current Projects and Accomplishments 14

Goals and Strategies 14

Figure 1: Net Energy Consumption by Fuel Type in Nebraska..... 6

Figure 2: Total Energy Consumption by Fuel Type in Nebraska 1960-2011 7

Figure 3: Nebraska Energy Consumption and Costs by Sector 2012 7

Figure 4: Heat Loss in Houses 8

Figure 5: Wind Capacity Additions Per Year 9

Figure 6: Wind Power Density 10

Figure 7: Biomass Resources – Crop Residues 10

Figure 8: Global Solar Radiation at Latitude Tilt - Annual 12

Table 1: Wahoo Electrical Consumption in kWh by Year and Sector 5

Table 2: Average Annual Gas and Electric Expenditures 5

Introduction

Energy plays a crucial role in nearly every aspect of our lives. It is used to grow our food, to move us from place to place, to light our homes, and to make the products we buy. The vast majority of our energy is currently supplied by fossil fuels, which are nonrenewable resources. Federal regulations are tightening emission rules for power plants, thus increasing the cost of using fossil fuels. By planning for energy and its use, Wahoo can save money, have a more resilient economy, conserve natural resources, and be better prepared for the future.

Acknowledgements

City of Wahoo and Wahoo Utilities

The Nebraska Energy Office

National Renewable Energy Laboratories (NREL)

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Council (EISPC)

AWS Truepower

American Wind Energy Association

The U.S. Environmental Protection Agency

U.S. Energy Information Administration (EIA)

International Renewable Energy Agency

Nebraska Energy Policy Overview

Nebraska Legislation LB997

In 2010, Nebraska Legislators passed LB 997 requiring all municipalities and counties, with the exception of villages, to adopt an energy element into their comprehensive plan by January 1, 2015. Energy elements are required to have three components:

1. Energy infrastructure and energy use by sector
2. Utilization of renewable energy sources
3. Energy conservation measures that benefit the community

The following energy element is included as part of Wahoo's Comprehensive Plan in order to fulfill the requirement of LB 997.

Nebraska Energy Plan

The 2011 Nebraska Energy Plan outlines 14 strategies for the state to consider in meeting the following objectives:

1. Ensure access to affordable and reliable energy for Nebraskans to use responsibly
2. Advance implementation and innovation of renewable energy in the state
3. Reduce petroleum consumption in Nebraska's transportation sector

These strategies identified by the state are:

- Continue support of Nebraska's unique public power system
- Increase opportunities for demand-side energy management and energy efficiencies
- Maximize the investment in Nebraska's coal plants
- Expand Nebraska's nuclear power generation capacity

- Increase opportunities for industrial and municipal waste-to-energy projects
- Optimize the use of Nebraska’s water resources for hydroelectric power generation
- Improve municipal water and wastewater management strategies and water quality
- Continue building Nebraska’s wind energy through public-private partnerships
- Increase opportunities for methane recovery from agricultural and community biomass resources
- Increase opportunities for woody biomass in Nebraska
- Support distributed generation of renewable technologies
- Increase ethanol production, blended and delivered across Nebraska and to markets outside the state
- Increase development and use of other alternative fuels
- Diversify and expand opportunities for renewable diesel in Nebraska

Nebraska Energy Code

Under §§81-1608 to 81-1616, the State of Nebraska has adopted the International Energy Conservation Code as the Nebraska Energy Code. Any community or county may adopt and enforce the Nebraska Energy Code or an equivalent energy code. If a community or county does not adopt an energy code, the Nebraska Energy Office will enforce the Nebraska Energy Code in the jurisdiction. Wahoo has adopted the 2003 International Energy Conservation Code. The purpose of the Code, under §81-1608, is to insure that newly built houses or buildings meet uniform energy efficiency standards. The statute finds that:

there is a need to adopt the International Energy Conservation Code in order (1) to ensure that a minimum energy efficiency standard is maintained throughout the state, (2) to harmonize and clarify energy building code statutory references, (3) to ensure compliance with the National Energy Policy Act of 1992, (4) to increase energy savings for all Nebraska consumers, especially low-income Nebraskans, (5) to reduce the cost of state programs that provide assistance to low-income Nebraskans, (6) to reduce the amount of money expended to import energy, (7) to reduce the growth of energy consumption, (8) to lessen the need for new power plants, and (9) to provide training for local code officials and residential and commercial builders who implement the International Energy Conservation Code.

The Code applies to all new buildings, as well as renovations of or additions to any existing buildings. Only those renovations that will cost more than 50 percent of the replacement cost of the building must comply with the Code. There are exceptions to the Nebraska Energy Code including: buildings that are neither heated nor cooled, buildings registered as a historic place, or buildings with very low average energy use. Visit the Nebraska Energy Office website to see all the rules, regulations, and exceptions regarding the Energy Code.

Nebraska Legislation LB436 - Net Metering

The Nebraska Legislature passed LB436 in 2009 which allows for net metering. Net metering is the process in which a citizen has the opportunity to generate their own energy and send excess energy onto the grid. The utility company purchases the excess energy from the customer through credits. Net metering was found to be in the public interest because it encourages customer-owned renewable energy sources. Net metering can stimulate the economic growth, encourage diversification of the energy resources used, and maintain the low-cost, reliable electric service for the State of Nebraska.

In Wahoo, there are two qualified facilities with a total estimated generating capacity of six kilowatts (kW). The estimated net kilowatt-hours (kWh) received from customer-generators is 1020 kWh. The total energy these generators have produced is 7200 kWh.

Solar and Wind Easements and Local Option Rights Laws

Nebraska's easement provisions allow property owners to create binding solar and wind easements in order to protect and maintain proper access to sunlight and wind. Counties and municipalities are allowed to develop zoning regulations, ordinances, or development plans that protect access to solar and wind energy resources. Local governing bodies may also grant zoning variances to solar and wind energy systems that would be restricted under existing regulations, so long as the variance is not substantially detrimental to the public good.

For summaries of additional programs, incentives and policies in Nebraska visit the Database of State Incentives for Renewables & Efficiency (DSIRE) website:

<http://www.dsireusa.org/incentives/index.cfm?re=0&ee=0&spv=0&st=0&srp=1&state=NE>

Energy Infrastructure

The Wahoo Utility Department provides electricity for the city of Wahoo and the village of Weston, and natural gas for Wahoo. Wahoo Utilities staff estimates 40% of Wahoo's electricity comes from 'green' sources with output purchases from the Cooper Nuclear Station near Brownville, hydroelectric facilities, and wind farms. The electric utility currently has nine full time employees; five employees for the electric distribution system and four at the power plant. The power plant has six diesel/natural gas generators with a total capacity of 13.5 megawatts (MW). The Wahoo Utilities Department Office is located at 605 N. Broadway Street.



<http://www.wahoo.ne.us/vnews/display.v/SEC/Wahoo%20Utilities%7CUtility%20Department%3E%3EElectric>

Wahoo Utilities receives natural gas from one tap on the Northern Natural Gas Transmission pipeline. The gas is transported to the TBS (Town Border Stations) at 400 psig (pounds per square inch gauge pressure). Delivery pressure is reduced to 60 psig then transported to District Regular Station (DRS) 1 and DRS 2 where pressure is reduced to 8 psig for most of the Wahoo natural gas distribution system. Wahoo Utilities operates approximately 33 miles of distribution main.

Energy Use

Table 1 shows Wahoo’s electricity consumption in kWh by sector. All sectors, with the exception of irrigation, consumed more electricity in 2013 than in 2012. Total consumption increased by 3.05%. The year 2012 was exceptionally dry, which led to increased electricity use for irrigation. The trend of overall increasing energy consumption in Wahoo is consistent with the statewide trend shown in figure 3.

Table 1: Wahoo Electrical Consumption in kWh by Year and Sector

Sector	2012	2013	% Change
Residential	24,211,831	24,834,811	2.57%
Commercial	28,887,734	29,409,898	1.81%
Industrial	6,521,480	7,038,184	7.92%
Municipal	3,160,401	3,548,440	12.28%
Irrigation	479,214	360,714	-24.73%
Total	63,260,660	65,192,047	3.05%

Data from Wahoo Utilities

As residents of Wahoo increase their energy consumption, they will pay more for energy. On average, the residents of Wahoo spent about \$1,760 on gas and electric bills in 2013. As seen in Table 2, that is a 10% increase from 2012. Many factors affect electricity expenditures including: use patterns, weather, and economics. For example, an unusually hot summer will cause an increase in electricity consumption for air conditioning.

If Wahoo continues to increase consumption, the utilities department will likely need to invest in infrastructure/capacity upgrades which will be paid through utility rates. Although things such as the weather are uncontrollable, there are certain things Wahoo can control. It is in the residents’ and the city’s interest to increase energy efficiency so that less money will be spent on utility bills and infrastructure upgrades and more money into the local economy. Links to energy saving tips are located in the education and funding sections below.

Table 2: Average Annual Gas and Electric Expenditures

2012	2013	% Change
\$1,598.97	\$1,760.13	10.08%

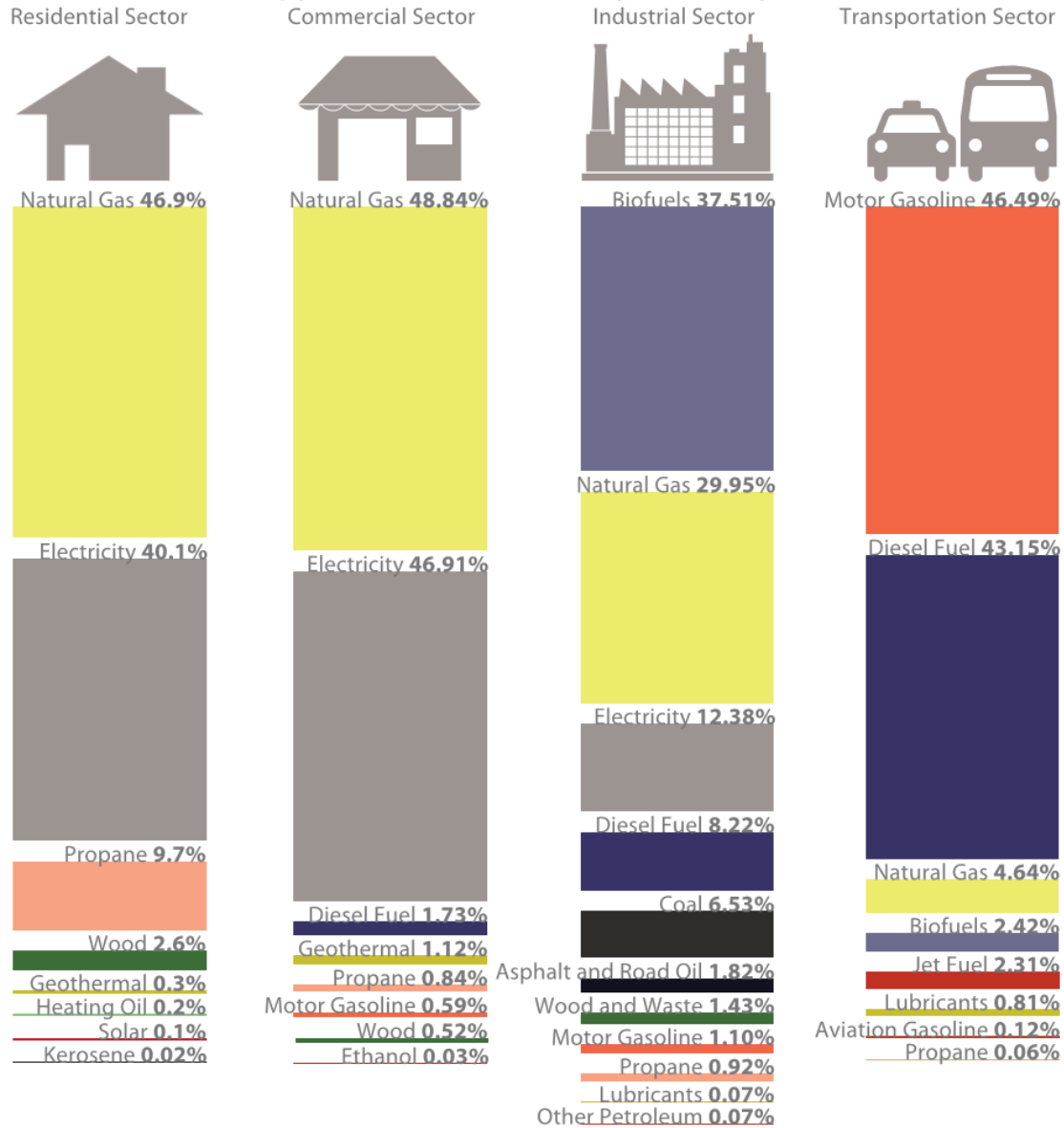
Data from Wahoo Utilities

Nebraska Energy Statistics

The following statewide data is included within the Wahoo Energy Element in order to provide context for the Wahoo consumption data. Figure 1 shows the net energy consumption by fuel type in the residential, commercial, industrial, and transportation sectors. In Nebraska a majority of the energy spent in the residential and commercial sectors in the form of natural gas and electricity is for heating, cooling, and lighting buildings. The state’s industrial sector relies on biofuels for 37.51% of its energy consumption.

Figure 1:

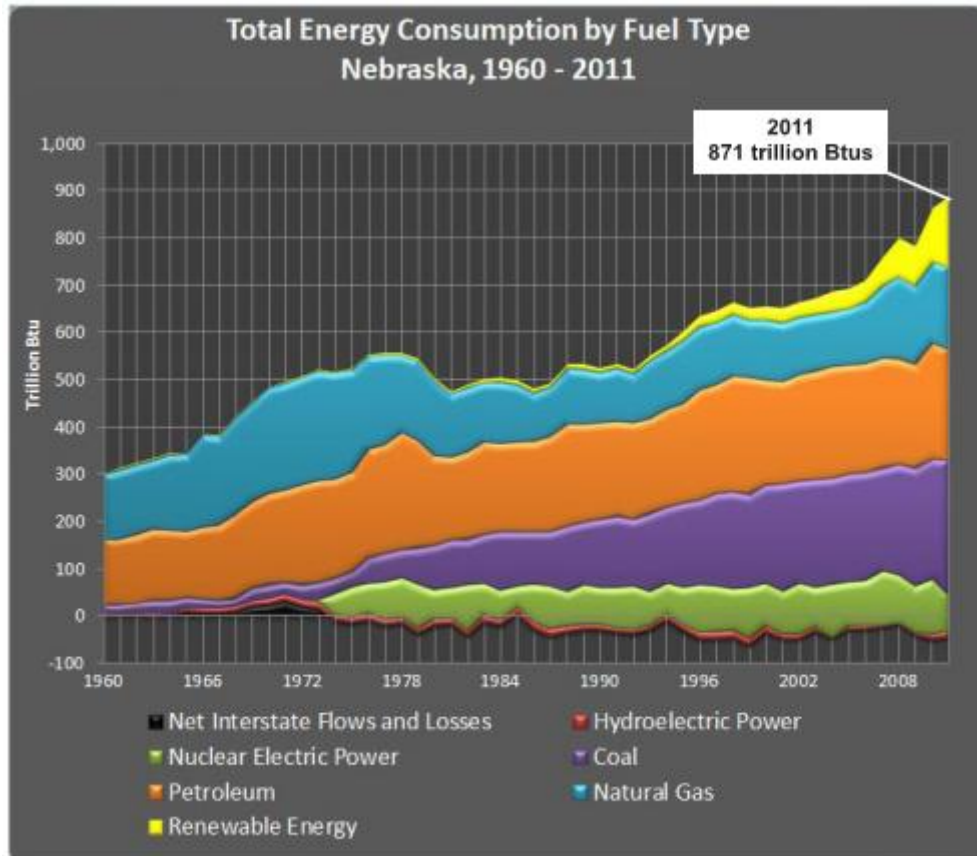
2011 Net Energy Consumption by Fuel Type in Nebraska



Data for figure 1 is from the Nebraska Energy Office.

As shown in figure 2, Nebraskans rely on fossil fuels for an overwhelming majority of their energy needs. Energy consumption continues to increase from year to year with Nebraskan's consuming 871 trillion BTUs in 2011. Natural gas and renewable energy consumption are expected to increase in the future as concerns for emissions increase and as these sources become more economical.

Figure 2:







Sources: State Energy Data Report. Energy Information Administration, Washington, DC.
Nebraska Energy Office, Lincoln, NE.

Figure 3 shows how much energy Nebraska consumed in 2012 and how much money Nebraska spent on energy in 2012. Total energy consumption decreased by 10 trillion BTUs from 2011 to 2012, or 1%. Even though transportation consumption was just under 23% of the total in 2012, Nebraska spent more money on transportation than residential, commercial and industrial energy uses combined.

Figure 3:

Nebraska Energy Consumption and Costs By Sector, 2012

	 Residential	 Commercial	 Industrial	 Transportation	TOTAL
ENERGY	IN TRILLION BTU				
	147.0	131.9	384.8	196.9	860.6
	17.1%	15.3%	44.7%	22.9%	100%
COSTS	IN MILLIONS OF \$				
	1,390.3	990.5	2,289.5	5,423.0	10,093.3
	13.8%	9.8%	22.7%	53.7%	100%

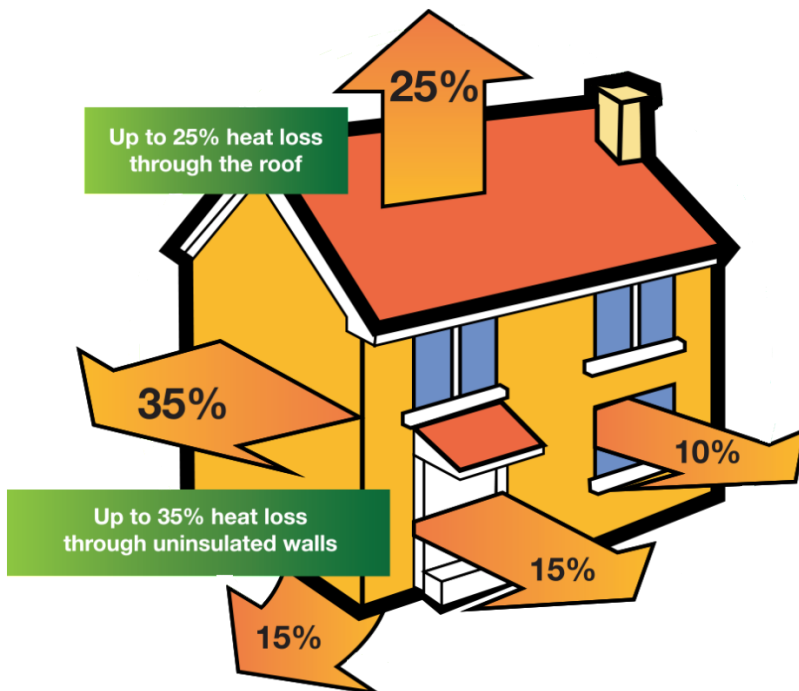
Opportunities for Energy Conservation

Improving Efficiency

According to the 2012 American Community Survey (ACS), over 61% of the houses in Wahoo were built before 1970; 37% before 1940. These homes are an opportunity for Wahoo to significantly reduce its energy use. In older homes, improvements in insulation, windows, appliances and lighting can cause them to be significantly more energy efficient and save the homeowner in energy costs. Figure 4 shows the common places houses lose heat. Up to 60% of heat loss is through the roof and uninsulated walls.

There are a number of programs and incentives available for homeowners and business that want to improve their energy efficiency. These programs and incentives are described in the education and funding sections below.

Figure 4: Heat Loss in Houses



Graphic from: www.eco-uk.co.uk

Transportation

The average commute to work for the citizens of Wahoo is 23 minutes (ACS 2012). Over 83% of them drive alone (ACS 2012). The citizens of Wahoo are spending a lot of time, money, and energy getting to work. Strategies to reduce energy use for transportation include: invest in trails, sidewalks, and multi-modal transportation infrastructure, encourage carpooling, and encourage local economic development to increase local jobs and provide more employment opportunities.

Landscaping

A well-designed landscape not only improves the aesthetics of a home or business, it can also reduce water use and lower energy bills. According to the Nebraska Energy Office, a well-designed landscape

saves enough energy to pay for itself in less than eight years. For example, when planted in the right spot, trees can provide shade from the sun in the summer and block the cold wind in the winter.

Recycling and Composting

Recycling and composting preserves energy by reducing the energy needed to extract raw materials. For example, using recycled aluminum scrap to make aluminum cans uses 95% less energy than making aluminum cans from raw materials (EIA). Recycling and composting also reduce the amount of solid waste dumped in the landfill, which allows landfills to stay open longer.

Opportunities for Renewable Energy

Renewable Energy Sources

Nebraska is the only state in the U.S. that is 100% public power. Since public power districts (and local utilities like Wahoo Utilities) are not seeking profits, they have been able to maintain some of the lowest electricity prices in the nation. The low cost of energy is one of the reasons that Nebraska has not fully taken advantage of its renewable energy potential. Unlike places such as California, where electricity prices are high, renewable energy systems have historically not been economical for Nebraska. Below is a summary of potential renewable energy options for Wahoo:

Wind

According to the American Wind Energy Association, Nebraska has one of the best wind resources in the United States; 92% of Nebraska has the adequate wind speeds for a utility scale wind farm. Nebraska ranks 3rd in the U.S. in gigawatt hour (GWh) wind generation potential, but has been slow in utilizing this resource compared to other states. Nebraska currently ranks 20th in total MW installed with 735 MW. According to the National Renewable Energy Laboratory, Nebraska's wind potential at 80 meters hub height is 917,999 MW. Wind Power is capable of meeting more than 118 times the state's current electricity needs. As seen in figure 5, Nebraska added a significant amount of wind capacity between 2011 and 2013, and will likely continue to increase wind capacity in the future.

Figure 5:

Wind Capacity Additions Per Year	
2011	124.5 MW
2012	122 MW
2013	74.8 MW
Total	321.3 MW

source: American Wind Energy Association

As seen in figure 6, Wahoo and the rest of Saunders County have excellent wind resources with wind power densities ranging from 400 to 500 watts per square meter. Electricity produced through wind power will be most cost effective on the utility/commercial scale. Small scale wind systems for homes and businesses may not be as cost effective, but they should be encouraged in appropriate settings. Small scale wind systems can be utilized to lower the owner's monthly utility bill in areas with net metering. Wahoo and Saunders County zoning regulations will guide any wind development towards appropriate land uses and locations.

Figure 6:

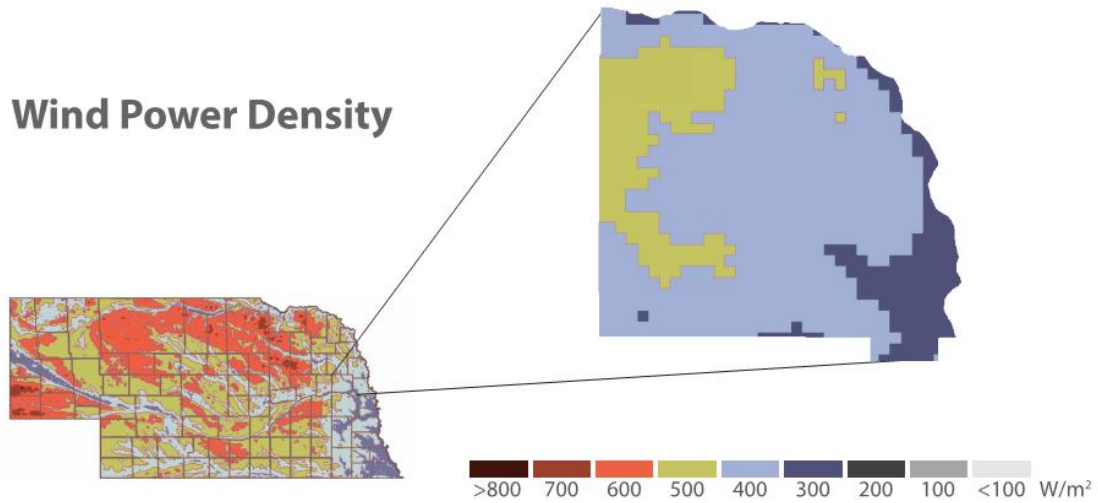


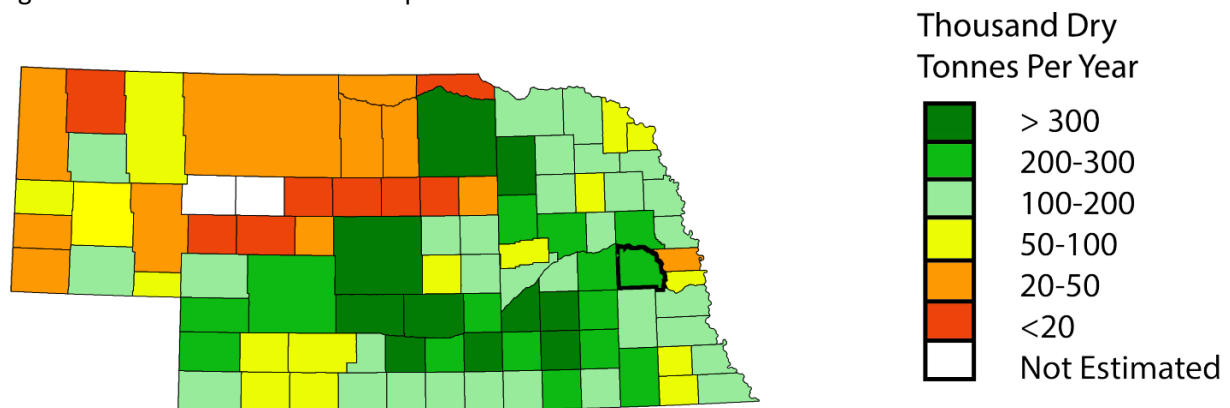
Figure 6 represents the gross estimated annual average wind power density for Nebraska and Saunders County. This data indicates how much energy is available for conversion by a wind turbine at a particular location. This map was created with data from EISPC and AWS Truepower.

Biomass

National Renewable Energy Laboratory data (Figure 7) suggests that Saunders County has approximately 200-300 metric tons of crop residues per year, which is among the highest in the state. This data is estimated using total crop production (data from USDA 2012 Census), crop to residue ratio, and moisture content. It assumes that only 35% of the total residue could be collected as biomass. The remaining portion is to be left on the field to maintain ecological and agricultural functions.

Direct-fired System- Most biomass plants that generate electricity use direct-fired systems. Simply, these plants burn biomass feedstock directly to produce steam. This steam turns a turbine, which turns a generator that converts the power into electricity. The feedstock for direct systems can be a number of things including: wood and wood waste, agricultural residues, municipal solid waste, or industrial waste. Direct-fired systems currently provide energy for a number of manufacturing facilities, two colleges, and other buildings across Nebraska.

Figure 7: Biomass Resources – Crop Residues



Biodiesel- The two Nebraska commercial scale plants located in Arlington and Scribner have an estimated production capacity of 5.4 million gallons per year, but both closed in the late 2000's due to the price of soybeans used for feedstock.

Ethanol- Ethanol produced from corn and grain sorghum is a growing energy resource in Nebraska. According to the Renewable Fuels Association, Nebraska has the second largest ethanol production capacity in the nation and the second largest current operating production in the nation. Approximately 14% of the nation's ethanol capacity is in Nebraska's 27 ethanol plants.

Ninety-one percent of Nebraska's ethanol production goes to U.S. domestic markets, 5% is exported to other countries, and 4% is used by Nebraskans. The Nebraska Ethanol Board estimates that 40% of Nebraska's corn crop and 75% of the state's grain sorghum crop are used in the production of ethanol.

Ethanol consumption is mainly in the form of blended gasoline. Ethanol production and consumption is expected to continue to increase as national legislation continues to affect state policies. The Renewable Fuel Standard, established in 2005 as a part of the Energy Policy Act, requires a minimum of 36 billion gallons of renewable fuel to be used in the nation's gasoline supply by 2022. In 2013, 87 octane fuel without ethanol began to be phased out and replaced with an ethanol-blended 87 octane gas. Nearly all fuel stations in Nebraska and Iowa have phased out 87 octane fuel without ethanol as of 2014.

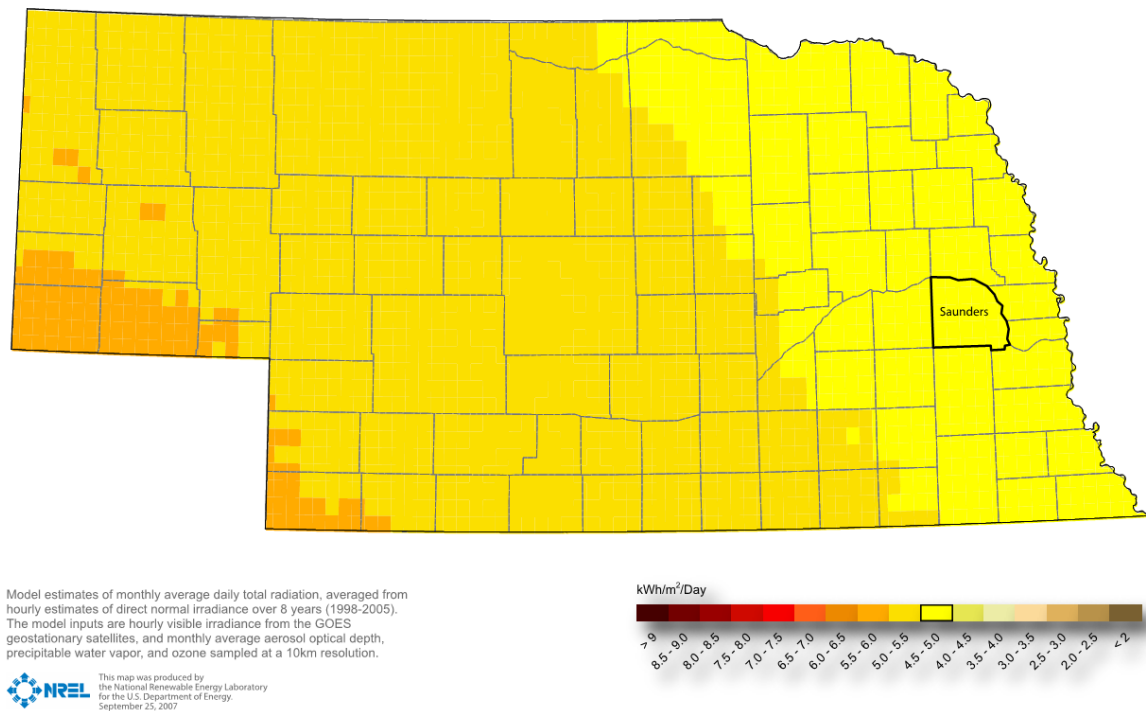
Biogas- Biogas is a product of the decomposition of manure, via anaerobic digestion, and is typically made of about 60% methane, and 40% carbon dioxide. Biogas can be used to generate electricity, as a boiler fuel for space or water heating, upgraded to natural gas pipeline quality, or other uses. After the production of biogas, the remaining effluent is low in odor and rich in nutrients. The byproducts of biogas production can be used as fertilizer, livestock bedding, soil amendments or biodegradable planting pots. For additional information about biogas visit: <http://www.epa.gov/agstar/anaerobic/>.

Solar Power

According to the National Renewable Energy Laboratory, Nebraska is ranked 13th in solar energy potential. As seen in Figure 8, Wahoo and the rest of Saunders County has an average solar radiation of 4.5-5.0 kilowatt hours per square meter per day. Currently, solar technologies are marginally used in Nebraska because it has historically been difficult for solar technologies to compete with the state's low electric rates.

According to the International Renewable Energy Agency, the cost of solar photovoltaic (PV) panels decreased nearly 80% from 2009 to 2013. As the cost of solar panels continues to decrease, solar can be utilized at an individual home or business scale to help supplement electrical needs. Federal and State agencies have incentives such as tax credits and rebates to help with the cost of solar, but additional steps could be taken to encourage solar generation in Wahoo. Although all utilities in Nebraska are required to allow net metering according to LB 436, some utility companies, such as Lincoln Electric System (LES), have additional solar incentives. LES has a performance based incentive, as well as a rebate program for solar systems. Ultimately, economics will determine the amount of solar generated in Wahoo. In addition, zoning regulations will direct the type and use of solar power in appropriate areas of Wahoo.

Figure 8:
Global Solar Radiation at Latitude Tilt - Annual



Passive solar- Passive solar design takes advantage of a building’s site, climate, and materials to minimize energy use. A well-designed passive solar home first reduces energy use for heating and cooling through energy-efficiency strategies and then meets the reduced need in whole or part with solar energy. In simple terms, a passive solar home collects heat as the sun shines through south-facing windows and retains it in materials that store heat, known as thermal mass.

Geothermal

There are many geothermal applications including: direct use, electricity production, open loop heat pumps (a.k.a ‘pump and dump’), and closed loop heat pumps. The type of geothermal application that is most practical and economical for the residents of Wahoo, and conforms to the city’s standards, is the use of closed loop geothermal heat pumps. Closed loop systems move fluids through continuous pipeline loops that are buried underground at depths where the temperature does not fluctuate much. Heat picked up by the circulating fluid is delivered to a building through a traditional duct system. Geothermal heat pumps discharge waste heat into the ground in the summer months and extract heat from the ground in the winter months.

Geothermal heat pumps are slowly becoming a popular method of heating and cooling buildings. Heat pumps use much less energy than traditional heating and cooling systems. This translates into energy and money savings while also reducing air pollution. There are many state incentives to help with the initial cost of geothermal energy.

Education

Wahoo will not be able to achieve its energy goals without the help of its citizens. Wahoo should educate the public on the benefits of energy efficiency and the most feasible renewable energy systems. In the following subsections there are resources provided that Wahoo can use to raise awareness regarding energy efficiency and renewable energy systems.

Energy Saving Tips

The Nebraska Energy Office has listed ways to save money on energy bills for the home, farm, business, or vehicle. Options for energy savings are listed on the Office's web site at <http://www.neo.ne.gov/tips/tips.htm>.

The U.S. Department of Energy created a document that explains tips on saving money and energy at home: http://energy.gov/sites/prod/files/2014/05/f16/Energy_Saver_Guide_Phase1_Final.pdf

Jobs and Economic Development Impact Models (JEDI)

Developed for the National Renewable Energy Laboratory, the JEDI models were created to demonstrate the economic benefits associated with renewable energy systems in the United States. This model can be used by anyone: government officials, decision makers, citizens. The model is simple, the user enters in information about the project and it will generate economic impact data such as jobs, local sales tax revenue etc.

Funding

Although energy efficiency upgrades and some renewable energy applications will save money over time, the initial costs can be burdensome. Below are some incentives, programs, and resources that Wahoo can use to help with the initial costs of energy efficiency and renewable energy.

Financial Incentives

There are a number of federal and state incentives for renewable energy production and energy efficiency. These include:

- Renewable Energy Tax Credit (Corporate)
- Renewable Energy Tax Credit (Personal)
- Property Tax Exemption for Wind Energy Generation Facilities
- Sales and Use Tax Exemption for Community Wind Projects
- Sales and Use Tax Exemption for Renewable Energy Property
- Dollar and Energy Savings Loans (State Loan Program)

For summaries of additional programs, incentives and policies in Nebraska visit the Database of State Incentives for Renewables & Efficiency (DSIRE) website:

<http://www.dsireusa.org/incentives/index.cfm?re=0&ee=0&spv=0&st=0&srp=1&state=NE>

Grants

In 2010, Wahoo was awarded an Energy Efficiency and Conservation Block Grant (EECBG) for City Hall and Wahoo Civic Center facilities heat pumps, as well as lighting upgrades. The city of Wahoo should continue to explore grant opportunities from the Nebraska Energy Office, U.S. Department of Energy, and other agencies that distribute funding for energy projects to help fund energy conservation or renewable energy projects.

Energy Assistance Programs

Residents wanting help paying their utility bills visit the following website with links to many programs in Nebraska: <http://nebraskaenergyassistance.com/assistance/>

The Weatherization Assistance Program helps lower income families save on their utility bills by making their homes more energy efficient. The Nebraska Energy Office administers the federally-funded program. The following website describes the program and how to apply:

<http://www.neo.ne.gov/wx/wxindex.htm>

Current Projects and Accomplishments

Wahoo Utilities continues to provide a reliable service to their customers while lowering costs. The Wahoo Utilities Department has been implementing measures and strategies to lower energy cost and reduce the need for increased generation capacity. Some of these include:

- Generation of electricity when required by NPPD
- Payment to Saunders Medical Center to generate power when peaks are expected
- Operating the generator at the wastewater plant for the lift station
- Wahoo currently generates an estimated 40% of their electricity from 'green' sources

Goals and Strategies

The following generalized energy goals and strategies have been identified for the city of Wahoo:

Goal 1: To reduce energy use per capita in Wahoo

- a. Ensure efficient use of land resources
 - i. Encourage new development adjacent to existing development
 - ii. Encourage infill development
 - iii. Encourage mixed use development
- b. Take advantage of programs and incentives offered by state agencies
- c. Increase the energy efficiency of buildings within Wahoo
 - i. Educate homeowners regarding practical energy efficiency measures
 - ii. Encourage meeting current LEED standards for new buildings and renovations in Wahoo

- iii. Encourage residential and commercial energy upgrades
- iv. Encourage energy conservation through the siting of development and landscaping
- d. Continue to encourage recycling in Wahoo
- e. Educate citizens regarding the energy element
 - i. Implement education, outreach and citizen engagement strategies
 - 1. Continuing the utilization of the city's webpage to inform citizens of its energy related efforts, as well as provide energy saving tips
 - 2. Develop an energy saving demonstration area at a highly visible public facility
 - ii. Recognize local projects that support the goals and strategies of the energy element

Goal 2: To increase the amount of renewable energy generated in Wahoo

- a. Inform citizens about practical renewable energy options
- b. Examine and remove any unintended barriers that may exist for appropriate renewable energy generation such as height restrictions or setback requirements
- c. Evaluate the feasibility of producing renewable energy from a city owned facility
- d. Encourage renewable energy use in buildings
- e. Consider additional output purchases from renewable sources

Goal 3: To further reduce energy consumption within the city of Wahoo's operations

- a. Conduct building energy audits on priority city buildings to identify energy retrofit and improvement opportunities
- b. Educate city staff regarding energy consumption
- c. Educate city staff on latest trends, energy codes, and systems
- d. Explore feasible on-site renewable energy applications in appropriate city facilities and projects
- e. Research funding opportunities to finance energy efficiency improvements
- f. Continue to work with Wahoo Utilities to regularly review and evaluate distribution systems, and other energy infrastructure
- g. Continue efforts already being performed by Wahoo Utilities Department

Definitions

LEED: Leadership in Energy & Environmental Design (LEED) is a green building certification program that recognizes best practices in building and construction. In order to receive LEED certification, building projects satisfy prerequisites and earn points to achieve different levels of certification. Building to LEED standards does not require LEED certification. (<http://www.usgbc.org/leed>)