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Energy Planning in Nebraska: Evaluating Energy Elements of Local Comprehensive Plans in Nebraska

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Evaluating Energy Elements of Local Comprehensive Plans in Nebraska

By

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In 2010, Nebraska Legislature passed LB 997 requiring all Nebraska cities and counties to include an energy element within their local comprehensive plan by January 2015. For many communities, this is the first time energy has been addressed within their comprehensive plan. Energy planning literature and the requirements of LB 997 were used to create components of an ideal energy plan. Eighteen energy elements were selected by electronic availability and examined for components of an ideal energy plan. The results of this study show that energy elements of local comprehensive plans in Nebraska are lacking the components of an ideal energy plan, as well as components required in the language of LB 997. The absence of these components suggest Nebraska energy elements may not lead to meaningful action, nor will they lead to the many benefits that come from energy planning. The absence of LB 997 requirements may lead to comprehensive plans being deemed invalid. Barriers to the energy planning process are identified including: community opposition, costs, and unavailability of data. Lastly, this thesis identifies opportunities to improve the energy planning process through: the increased involvement of utility providers and other stakeholders, and educating community leaders, consultants, and the general public regarding energy planning.

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Chapter 1: Introduction

Problem Statement

Energy plays a crucial role in nearly every aspect of our lives. It is required for agriculture, transportation, to make the things we buy, and to heat and cool our homes. Energy has a profound effect on the economy, our health, and overall quality of life. An overwhelming majority of our current energy sources are fossil fuels. Although production of renewable energy has greatly increased in recent years, renewable energy was only 10% of the United States' total primary energy consumption in 2013 (EIA 2014).

Global energy demand is increasing exponentially, in part because of the significant growth of the world's population (Demirbas 2008). The world population has been growing exponentially since the beginning of the 19th century. The population doubled from three billion in 1959 to six billion in 1999, and added another billion in about ten years to get to its current population of seven billion people (Bell 2011). The world's population growth, along with new technologies that require energy from fossil fuels, has created an increasingly insatiable appetite for energy. The U.S. Department of Energy projects that U.S. energy consumption will increase by more than a third from 2006 to 2025, and electric power consumption is expected to increase by almost 40% during that time (EPA 2006).

The world's increased awareness of the population's effect on the environment has made the importance of energy planning more apparent. More and more people are coming to the conclusion that climate change is happening and happening quickly. Physical evidence of climate change, such as the Arctic ice cap melting, suggests that it may be happening at a faster rate than previously thought (Levy 2009). The fossil fuels used to provide energy release greenhouse gases, such as carbon dioxide. These greenhouse gases are not only linked to air pollution, but also thought to be the cause of climate change. Successful energy planning is important in order to find a way to reduce our consumption of greenhouse gas emitting fossil fuels and use alternatives in order to help the environment.

The impact energy has on the economy, the increased concern of fossil fuels' effect on the world in the form of climate change, and increased energy demand are all reasons that the importance of energy planning has become more apparent. Local energy planning is an opportunity to save money, create jobs, and protect the environment (Mackres and Kazerooni 2012).

In 2010, Nebraska Legislature passed LB 997 (see Appendix A) requiring Nebraska cities and counties to add an energy section into their comprehensive plan, by January 2015 (Nebraska Legislature LB997). This 'energy element' would: assess energy infrastructure, identify energy use by sector, evaluate the utilization of renewable energy sources, and promote energy conservation measures. For most communities in Nebraska, this will be the first time they have dedicated a section of the comprehensive plan for energy.

Project Overview

Energy elements are sections of local and county comprehensive plans, not large scale, regional, or statewide energy plans. Some energy elements were written as a part of a full comprehensive plan update; others were written separately and adopted as a part of the comprehensive plan. There are required components of an energy element within the language of LB 997, which include: energy infrastructure and energy use by sector, utilization of renewable energy sources, and conservation measures that benefit the community.

Energy planning literature provides a number of guides to energy planning (APA 2013, DOE 2013, NREL 2009, SCEO 2000). These guides have identified a number of components that are present in an ideal energy plan.

In the process of writing this thesis, I was given the opportunity to work for JEO Consulting Group Inc. During my time at JEO, I have been able to write over twenty energy elements for communities across the state. I believe this opportunity has given me a unique perspective that I would not have had if I were researching this topic without the experience of having written several energy elements. In this thesis I use this experience to enhance the evaluation of the selected energy elements, as well as to synthesize the results of my study of this topic. In an effort to remain objective, none of the energy elements that I have written are included in this study.

The focus of this thesis is to review several example energy elements of local comprehensive plans in Nebraska. The energy elements are evaluated for the presence of components of an ideal energy plan. The components of an ideal energy plan were gathered from energy planning literature and requirements of LB 997. The research questions for this thesis are as follows: (1) Do Nebraska community energy elements include the components identified in literature? (2) Do Nebraska community energy elements include the components required by LB 997? (3) Are there barriers to the energy planning process? (4) How can the energy planning process be improved in Nebraska? This research aims to improve energy planning at the local level by helping communities and the consultants that serve them identify: components of an ideal energy plan, current barriers, and opportunities to improve the process of writing an energy element.

Chapter 2: Literature Review

Before planning for energy, it is important to have a basic understanding of the following: the components of the energy planning process, the importance of planning for energy, the benefits of renewable energy and energy conservation, and the barriers renewable energy and energy conservation efforts face. The following sections review energy literature in order to highlight current energy issues, as well as provide the motivations for local communities to engage in energy planning.

Local Energy Planning Process

The local energy planning process is similar to other planning processes: identify the current conditions, determine priorities or goals, and create strategies to achieve those goals. The local energy planning process includes creating an energy profile or baseline for the community. The energy profile describes the current conditions and should include energy use and sources of energy. The energy priorities and goals identify what the community would like to achieve. The priorities and goals will depend on the community, but they may include: reducing energy use in the transportation sector, increasing energy efficiency in the built environment, or increasing distributed renewable energy use. Strategies are the specific actions the community identifies to achieve their energy goals. Strategies may include: adopting land use policies to encourage infill and mixed use development, examining the zoning ordinance for any unintended barriers to renewable energy production, such as height restrictions or setback requirements for accessory uses, adopting the latest energy conservation building code, or developing an education and outreach program to inform citizens about practical energy conservation measures.

Why is It Important to Plan for Energy on the Local Level?

There may be some people that do not understand why local energy planning is important if there are energy plans on the national or state scale. Energy planning needs to happen on the local level because local communities have a profound impact on what energy sources are consumed and how much energy is used. Local governments influence energy in many ways through: land use policy, transportation policy, building codes, the zoning ordinance, public projects, and education and outreach. Local communities can benefit from energy planning because they have the ability to make significant impacts on energy use. Local energy planning is important in order to: increase government efficiency, protect the environment, improve the health of citizens, reduce energy related costs, lead to a sustainable economy, and improve the overall quality of life in the community. The importance of energy planning is further described in the sections below.

Government Efficiency

As energy costs increase and city budgets tighten, creating an energy plan is a way to increase government efficiency. State and local governments in the United States spend approximately eight billion dollars a year on energy (DOE 2013). There is a potential in many buildings for energy costs to be reduced by twenty percent or more by using a number of energy efficiency measures (Granade et al. 2009). Local governments have the opportunity to reduce waste and save taxpayer dollars by creating an energy plan that focuses on government buildings and operations. After releasing its *Greenworks* plan, Philadelphia reduced its municipal energy consumption by 4.9% in the first two years, saving about $4 million in energy costs (Dews and Wu 2013). Creating an energy plan can also put a local government in a position to capture future funding opportunities if they have identified energy goals and priorities (DOE 2013).

Health and Environment

The vast majority of our energy sources are fossil fuels. The burning of fossil fuels produces emissions that have been linked to air pollution (Ristinen and Kraushaar 2006, National Academy of Sciences 2010). As energy use increases, emissions from the current mix of energy sources result in significant environmental impacts (Bathke et al. 2014). In the past it has been difficult to quantify the health and environmental impacts from the consumption of traditional energy sources. However, current research has attempted to quantify these impacts (Greene and Morrissey 2013, National Academy of Sciences 2010).

The National Academy of Sciences' (2010) report, "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use" attempts to define and evaluate the health, environmental, security, and infrastructure external costs and benefits associated with the production and consumption of energy within the United States. They labeled the costs as damages and determined a monetary value associated with them. For example, the damages associated from the emissions from coal-fired power plants in 2005 was $62 billion, or $156 million on average per plant (National Academy of Sciences 2010).

Renewable energy sources such as solar and wind do not produce the same harmful emissions as fossil fuels. Therefore, the use of renewable energy sources has a number of health and environmental benefits. In their research on the effects of Oklahoman wind energy, Greene and Morrissey (2013) found that the use of wind energy instead of coal resulted in a savings of millions of tons of CO_2, SO_2, and NO_x. The reduced emissions would result in health savings of over 1000 lives and thousands of reduced cases of nonfatal heart attacks, chronic bronchitis, and hospital admissions (Greene and Morrissey 2013). These positive health effects represent a savings of tens of millions of dollars annually (Greene and Morrissey 2013).

Economics

The entire economy is influenced by and relies on energy. Energy is required to grow the food we eat, make the things we buy, transport people and goods, and heat and cool our homes. As the cost of energy increases, the cost of everything that relies on energy increases, as well.

Energy use is increasing, due to factors such as people using more things that require energy and population growth (Demirbas 2008, Bell 2011). This trend is expected to continue. The U.S. Department of Energy projects that U.S. energy consumption will increase by more than a third from 2006 to 2025, and electric power consumption is expected to increase by almost 40% during that time (EPA 2006). In Nebraska, energy consumption has been steadily increasing since 1960 (Figure 2.1, NEO 2014). Nebraskans are not only consuming more energy; they are also spending more for energy. As seen in Figure 2.2, per capita energy expenditures in Nebraska have doubled since

2000 (NEO 2014). As people spend more money for energy, there is less for the local economy.

As fossil fuels are nonrenewable resources, they will inevitably become depleted. Increasing energy use will hasten the depletion of nonrenewable resources. It is simple economics that a smaller supply will lead to larger demand, and thus increased costs.

As energy consumption increases, utility companies need to increase generation and upgrade energy infrastructure both of which are very costly. In order to pay for these upgrades, utility companies need to increase rates. Therefore, increasing energy efficiency would lessen the need for additional power plants and infrastructure upgrades, save money in avoided costs, and keep energy rates low (National Action Plan for Energy Efficiency 2007, Granade et al. 2009).

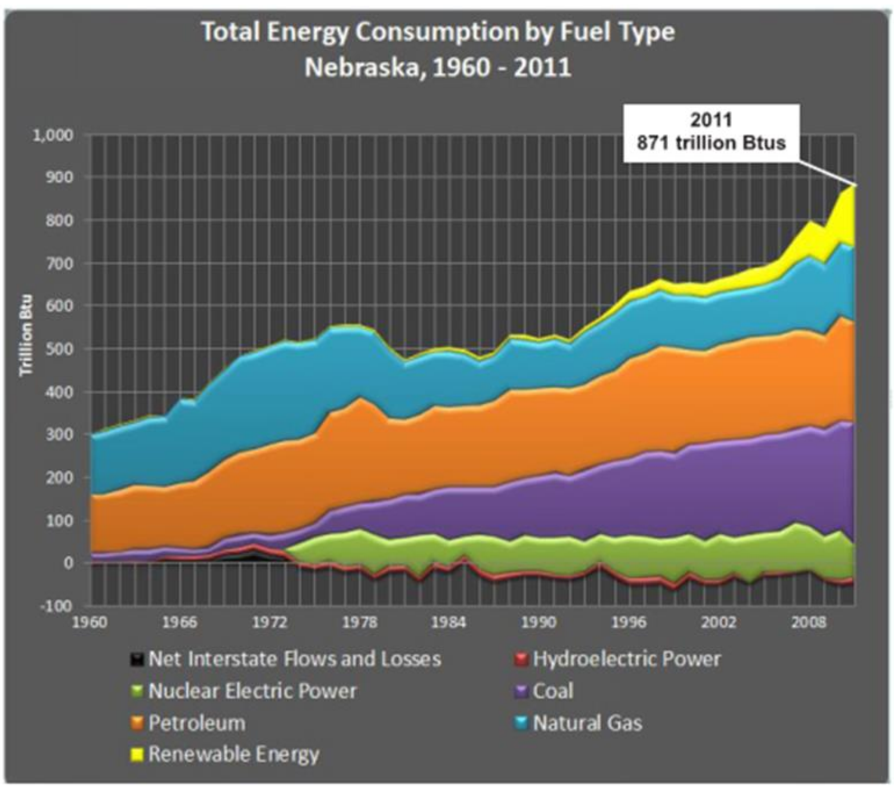

Figure 2.1 Total Energy Consumption by Fuel Type: Nebraska, 1960 – 2011
Source: Nebraska Energy Office Annual Report, 2013

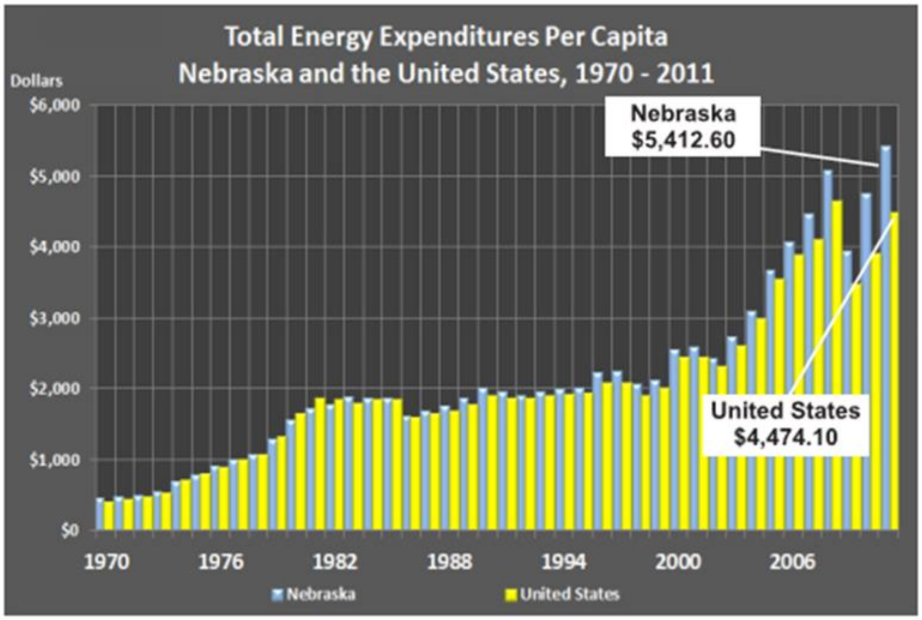

Figure 2.2 Total Energy Expenditures Per Capita: Nebraska and the United States, 1970-2011
Source: Nebraska Energy Office Annual Report, 2013

Planning for renewable energy production has a number of benefits on both the state and local levels. If the federal government were to adopt a cap and trade program, in which states are given limits to their emissions and allowed to trade emission credits, states that increase renewable energy production would stand to benefit. Greene and Morrissey (2013) suggest that in a cap and trade program, Oklahoma would have a net benefit of tens of millions of dollars. Local communities that plan for renewable energy can attract companies in the renewable energy industry. For example, since the 2007 adoption of its *Green Vision*, the City of San Jose California, has attracted 4,000 jobs and a number of renewable energy technology companies, including: SunPower, SoloPower, Stion, and Sunwize (DOE 2013).

Currently, the cost of producing renewable energy is higher than the cost of using fossil fuels (Doris et al. 2009). However, the cost of some renewable energy applications has decreased in recent years. For example, the total installed cost for distributed solar photovoltaic systems decreased 33 percent from 2010 to 2013 (Peterson, Coddington, and Pless 2014). Renewable energy sources such as wind and solar do not have fuel costs, which saves money over time. Solar power is becoming increasingly cost competitive with traditional energy sources, as it is anticipated that by 2016 solar systems will reach grid parity in 47 states, including Nebraska (Peterson, Coddington, and Pless 2014).

The cost of inaction is very high. As a majority of current energy comes from nonrenewable fossil fuels, a business-as-usual approach would lead to running out of current energy sources without the infrastructure to adapt globally and locally. Planning for energy and transitioning to renewable energy sources now will lead to the viability of the economy in the long term.

Barriers to Renewable Energy and Energy Conservation

Economic

Arguably, the largest barriers for renewable energy are economic factors. Renewable technologies tend to have higher up-front capital costs than conventional fossil fuel technologies (Doris et al. 2009). However, renewable energy technologies typically have lower operation and maintenance costs and lower, if not nonexistent, fuel costs compared to fossil fuels (Doris et al. 2009). A comparison of energy costs should account for the total life-cycle costs. Life-cycle costs include the initial capital costs, operation and maintenance costs, and any fuel costs over the equipment's lifetime. In many cases, when comparing life-cycle costs, renewable energy sources are comparable to conventional sources (Beck and Martinot 2004). Regardless, renewable energy development may be seen as too expensive because of higher up-front costs and the relatively low prices for fossil fuels (Wald 2009).

Transactional costs also influence the cost of renewable energy. Transactional costs cover project activities such as site assessments, permits, financing and negotiating power-purchase contracts (Doris et al. 2009). These costs tend to be flat regardless of project size, so a smaller renewable energy project will have a higher transactional cost for every kilowatt-hour (kWh) produced compared to a larger plant (Doris et al. 2009).

The cost of energy is a large factor in the decisions of policymakers. Many policymakers in states that have abundant fossil fuel resources and/or experience low electricity costs may be hesitant to promote renewable energy development that could increase the cost of electricity (Doris et al. 2009). However, states with high electricity costs, such as California, will be motivated to invest in renewable forms of energy in order to reduce costs (Doris et al. 2009).

Two other factors that influence investment in renewable energy are the health of a state's budget, and the disposable income of the residents (Doris et al. 2009). States that have stable or expanding government budgets and consumers with a disposable income are more likely to stimulate investments in renewable energy (Doris et al. 2009). Huang et al., agree, as they found that state affluence measured through total gross state product had a positive association with whether or not that state had an energy policy (2007).

Local governments may be hesitant to invest in energy efficient upgrades that will increase conservation because of the initial investment, but these technologies will eventually pay for themselves with the energy savings they will produce (Baker 2010).

Land Use Issues and Constraints

Planning laws and zoning regulations can greatly inhibit renewable energy development (Doris et al. 2009). Renewable energy projects often face long application timeframes, as well as delays and appeals, which can cause many projects to be delayed or canceled. Projects can also meet high public opposition due to aesthetics, noise, property values, habitat destruction, and water or land use issues (McLaren 2007). Renewable energy installations are often more visible than conventional energy sources and therefore have an increased chance for public opposition. For example, wind turbines and solar panels are typically in open spaces and are needed in large quantities, while conventional power plants are often in remote locations and shielded from view with fences or buildings (Doris et al. 2009). One of the most publicized oppositions to a renewable energy project is the Cape Wind project in Nantucket Sound (Cape Wind 2009). Community involvement early on in the planning process is important to address these issues and to reduce public opposition.

Technological

One technical barrier for renewable energy projects is that they are less energy dense than fossil fuels. A coal mine or oil field yields five to 50 times more energy per square meter than a solar facility, 10 to 100 times more than a wind farm, and 100 to 1000 times more than a biomass plant (Kerr 2010). Renewable energy projects need more space to produce the same amount of energy as conventional sources.

In the case of bio-fuels, such as ethanol, energy production from this source is very resource and energy intensive. The process of producing one gallon of ethanol requires the use of about three gallons of water (Ristinen and Kraushaar 2006). Also, because of the considerable use of fossil fuels in agriculture, it is unknown whether more energy is being consumed in the process than is being produced (Ristinen and Kraushaar 2006). Bio-fuels benefit from a large government subsidy, but it is unclear whether they would be economically viable without the subsidy because of how energy and resource intensive the energy production process is. Technological advances that could reduce the amount of resources and energy needed to produce bio-fuels would go a long way in making them more viable in the open market. Although, even with these technological advances, it is unlikely that ethanol will ever be able to replace gasoline. If the entire United States corn crop were used to produce ethanol, it would replace about 15% of the United States' annual gasoline use (Kerr 2010).

Another barrier is the intermittency of renewable energy. Solar panels and wind turbines can only generate energy when the sun is shining and the wind is blowing. Coal, gas or nuclear power plants operate 75% to 90% of the time; meanwhile, wind turbines typically are idle 65% to 80% of the time (Kerr 2010). Scientists and engineers have not yet developed the technology to store solar or wind energy, and the intermittency of these energy sources has made them seem unreliable.

Transmission

Relatively little investment in transmission infrastructure has been made in the United States during the past 15 to 20 years, and lack of transmission access is a barrier to increased renewable energy development in some areas (Doris et al. 2009). The development of a smart grid is another potentially critical part of renewable energy development. The ability of a smart grid to manage dispersed and intermittent energy generation could provide a boost to renewable energy development. The federal government set aside $4.5 billion for electricity delivery and reliability in Title IV of the 2009 American Recovery and Reinvestment Act (Doris et al. 2009). The development of a smart grid would make decision makers more comfortable investing in renewable energy, knowing that the system, overall, is more reliable.

Educational

Public opposition can be a major barrier to renewable energy. The public's lack of information on the economic and environmental benefits associated with renewable energy could create opposition that makes implementing renewable energy projects more difficult or even prevent them altogether (Monroe and Oxarart 2010). In 2001, only 12% of the U.S. public could pass a basic quiz on energy (Monroe and Oxarart 2010). Thus, proper communication with the public during the planning process, along with public education programs, will cause renewable energy projects to be more successful (Monroe and Oxarart 2010).

Planning and Policy Solutions

Although planners and policy makers cannot likely change certain barriers to renewable energy and energy conservation, such as technological ones, they can attempt to find solutions to the economic and land use barriers that hinder renewable energy development. Below are a few possible solutions to those barriers identified from current research.

Financial Incentives

Financial incentives are important in order for renewable energy to become attractive in the open market. However, at a certain point, incentives can grow so large that they don’t present a net benefit for the market. Therefore, sound policy needs to have a balance of costs and benefits when attracting new investment (Lantz et al. 2010). Policy aimed at increasing renewable energy has historically focused on financial incentives. Property tax rebates, income tax credits, grants, loans and sales tax exemptions are common, while infrastructure improvements may be part of broader incentive packages (Lantz et al. 2010).

One example of a financial incentive is a rebate program. When a rebate program is properly designed it can significantly affect market growth (Lantz and Doris 2009). These programs provide a refund or discount off the cost of installing new renewable energy equipment (Lantz and Doris 2009). Programs typically are administered through local utility companies or state agencies, and the rebates are given after an application process (Lantz and Doris 2009). State rebate programs have had mixed success. Rebate programs regarding solar photovoltaic systems have been successful in stimulating the market but other programs aimed at small wind turbines, solar hot water, and biomass have not had the same success (Lantz and Doris 2009).

There are many federal and state policies that provide incentives and funding for renewable energy projects and energy efficiency upgrades (Doris et al. 2009). States and local municipalities should structure their incentive programs to complement the federal level incentives. Although financial incentives are great tools for stimulating more renewable energy, it is unlikely that they can achieve widespread renewable energy use alone; therefore, they should be a part of a larger energy plan (Doris et al 2009).

Laws & Regulations

In some cases, laws and regulations can be used to ensure fair access to resources and a level playing field for renewable energy technologies (Doris et al 2009). For example, laws can be structured to prohibit neighborhoods from explicitly restricting the installation or use of renewable energy equipment, while access and easement laws can help to create a balance between the use of a renewable resource, such as water, for energy production and competing needs (Doris et al 2009). Policies that discuss street orientation and building height can facilitate infrastructure that is open to renewable energy and responsive to public concerns (Doris et al. 2009). Planners should ensure that zoning laws and regulations do not unnecessarily prevent the installation of renewable energy technologies, such as small wind turbines or solar panels.

Another solution is to establish goals and targets for the use of renewable energy technology and link them with state and national goals. Renewable Portfolio Standards (RPS) requires electric utilities to ensure that renewable energy is a certain minimum percentage of their total energy generation by a certain date (EPA 2006, Carley and Miller 2012). Some form of RPS have been adopted in 37 states (Carley and Miller 2012). RPS have been successful in stimulating renewable energy development, and since they encourage a more diverse source of energy, they could actually lower energy prices (Fischer 2010).

Net Metering

Net Metering requires utility companies to pay customers who create their own electricity. Through net metering, when a user creates more power than they need, the excess power is sent back on the grid, and the utility company pays the customer the avoided cost or the cost the utility avoids by acquiring the energy (Stoutenborough and Beverlin 2008). Net metering "encourages private investment in renewable energy resources, stimulates the economic growth of this state, (and) encourages energy independence and security" (Stoutenborough and Beverlin 2008). Net metering has become a popular policy, as 36 states have adopted net metering policies since 1983 (Stoutenbourogh and Beverlin 2008).

Getting the Public Involved

Planning processes that encourage public involvement can increase support for a project. As previously mentioned, public participation is crucial in order to facilitate renewable energy development. Renewable energy projects with higher rates of public participation in the decision making process have been shown to have a higher likelihood of success (Doris et al. 2009).

Green Power Consumer Option and Disclosure Policy

A green power consumer option allows the consumer to choose if they would like a portion of their energy to come from renewable energy (Doris et al. 2009). A generation disclosure policy would provide customers with information about their electrical supply and can help them make informed decisions about the electricity and provider they choose (Doris et al. 2009).

Technology and GIS

Geographic Information System (GIS) can be used in a variety of ways to help the development of renewable energy and encourage energy conservation (Zhao et al. 2011, Horner et al. 2011). GIS is a tool that planners and researchers can use to site energy infrastructure, track energy consumption and identify areas suitable for conservation. Many researchers have developed models that show the importance of energy planning (Fu et al. 2009, Lin et al. 2010, Cai et al. 2011).

Set a Public Example

Public projects can set an example for the general population. Incorporating renewable energy in public projects can provide significant energy cost savings for state and local governments, create a market for renewable energy, and promote the implementation of renewable energy technology in the public and private sectors (EPA 2006). Government projects are highly visible, and implementing energy projects successfully can influence the private sector to invest in renewable energy and energy conservation methods.

The Planner's Triangle

There is a triangle of conflicting goals for planners. The triangle includes: economic growth, social justice, and environmental protection (Campbell 2012). Examining the triangle as it relates to energy planning, there are conflicts for every point.

Economic Growth

One of the largest barriers to renewable energy is the upfront costs, and the argument could be made that requiring local businesses to invest in renewable energy systems, efficiency upgrades or a certain Leadership in Energy and Environmental Design (LEED) certification standard could limit economic growth. Another argument is that by installing these systems, the businesses would save money on energy costs and thus allow them to invest more in the long term. Masanet (2010) would agree with the latter argument, as he found that energy-conserving technologies are beneficial to businesses. Evidence that energy planning does not have to come at the expense of economic growth comes from Denmark. Denmark's GDP grew 78% in 2007 while energy consumption grew only 7.4% higher in 2007 than 1980; CO2 emissions have been cut 20.5% during the same time period (Crncevic 2012).

Social Justice

Since renewable energy systems have high upfront costs, only those with a certain level of disposable income would be able to invest in them. An argument could be made that creating a system that rewards those who invest in renewable energy systems or punishes those who do not would be disproportionately affecting low-income residents. Some research has argued that small renewable energy projects can create significant socio-economic and ecologic benefits for rural communities (Venema and Calamai 2003). This research was focused on rural communities in developing countries, but perhaps it could be generalized to communities in developed countries as well.

Environmental Protection

Even with supposedly clean renewable energy systems there are some environmental concerns. Photovoltaic solar panels require some metals that may be harmful when mined (Ristinen and Kraushaar 2006). Wind turbines have been known to harm birds and bats because of the low barometric pressure or in instances of collisions (Parsons and Battley 2013). Of course, with careful planning these negative effects can be mitigated. Also, a cost-benefit analysis comparing the use of renewable energy systems or fossil fuels would show that the renewable energy systems would be less harmful to the environment (National Academy of Sciences 2010).

What Are Successful Communities Doing?

In his research, Pitt (2010) found that communities with the greatest success in energy planning achieved their success by engaging in multi-level governance processes in which the efforts of municipal staff and elected officials were complemented by significant contributions from a variety of private actors and regional collaboration. Not surprisingly, he also found that community participation was a key factor in the success of the communities' energy plans (Pitt 2010). Also, the presence of staff members dedicated to energy planning was found to be critical for communities that wish to pursue climate mitigation policies (Pitt 2010). This would lead to the conclusion that state and federal funding for local energy initiatives should also include the necessary staff and resources to create long-term energy policies (Pitt 2010).

Global energy planning

Municipalities all over the globe are practicing energy planning, and communities in the United States can learn from what the rest of the world is doing. Denmark has implemented many effective strategies that have made that country one of the world's leaders in energy planning (Crncevic 2012). Energy companies are required to charge, along with regular customer billings, a fee called a public service obligation that funds research and development and subsidizes environmentally friendly electricity production (Crncevic 2012). Denmark has also tried to decentralize energy production, so that the point of production is at or near the point of use (Crncevic 2012). Denmark has done all of this while growing its national economy (Crncevic 2012).

Other nations, such as in China and Spain, have begun to use technology in the form of models, simulators and GIS to create effective energy plans. Ivancic et al. (2004) used GIS to help develop an energy plan for Barcelona, Spain. Lin et al. (2010) and Cai et al. (2011) used models to show the importance of energy planning.

In their research of Canadian community energy plans, Denis and Parker (2009), found that most communities prefer voluntary supply and demand based incentives, rather than requirements. They also found that communities focused more on energy conservation and efficiency, rather than renewable energy production (Denis and Parker 2009). They argue that this may send a message that could hinder renewable energy development (Denis and Parker 2009). Calgary's purchase of wind-generated electricity to power the rail transit system is an example of a municipality taking action while increasing citizen awareness of renewable energy systems (Denis and Parker 2009).

Chapter 3: Legislative Bill 997

The state of energy in Nebraska before LB 997 was that of missed opportunities. As mentioned previously, total energy consumption in Nebraska has increased nearly 190% since 1960, and total energy expenditures have nearly doubled since 2000 (NEO 2014). Some of these changes can be explained by population growth and the increased use of electronics, but the pattern of development can also be to blame. “So often today our cities and developers are planning without even thinking about the energy required for their development plans” (Chad Johansen, Urban Affairs Committee: 2/9/2010).

Nebraska has not taken full advantage of the renewable energy resources that are available in the state. One of those resources is 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 (AWEA 2014). Nebraska ranks third in gigawatt hour (GWh) wind generation potential, but has been slow in utilizing this resource, compared to other states. Nebraska currently ranks twentieth in total MW installed, with 735 MW (AWEA 2014). Of that total, 321.3 MW was installed in the years 2011 to 2013 (AWEA 2014).

In 2010, Nebraska legislature passed LB 997, requiring Nebraska cities and counties to add an energy element into their comprehensive plan by January 2015 (Nebraska Legislature LB997). This bill amended Nebraska state statues sections 15-1102, 19-903, and 23-114.02 relating to comprehensive plans of counties and cities. Villages are exempt from LB 997. The language of the statutes amended by LB 997 is located in Appendix A. Energy elements are required to examine the following:

- Energy infrastructure and energy use by sector
- Utilization of renewable energy sources
- Energy conservation measures that benefit the community

Senator Heath Mello, who introduced the bill, believed LB 997 was an opportunity to benefit communities in a number of ways, including economics. “With an ever changing global economy, and public power stretched to its limits across our state, it serves a positive public purpose for communities to evaluate their energy consumption, energy conservation opportunities, and renewable energy potential” (Senator Mello, Urban Affairs Committee: 2/9/2010). As previously mentioned, local energy planning can attract new industries, reduce costs for residents, and improve government efficiency (Dews and Wu 2013, Granade et al. 2009, DOE 2013).

Through the introduction of this bill, Senator Mello was advocating for Nebraska to have a more progressive and proactive approach to energy policy. “Nebraska needs to be forward-thinking as the nation moves from one that is dependent upon fossil fuels to one that is energy efficient and uses renewable energy. This shift is already happening. And Nebraska can either make changes behind the curve or get ahead of it” (Senator Mello, Urban Affairs Committee: 2/9/2010).

Senators were given the impression that many communities have already started to plan for energy in some capacity. Kristi Wamstad-Evans, the sustainability coordinator for the City of Omaha, spoke during the hearing to confirm that Omaha already was incorporating energy into long range planning efforts. Mitch Paine’s statement during the hearing implied that many communities across the United States include energy within their comprehensive plans. “Including energy in comprehensive plans seems to be more main stream than out of the ordinary” (Mitch Paine, Urban Affairs Committee: 2/9/2010). Mr. Paine cited many examples of cities that incorporate energy within their comprehensive plan or have created an energy master plan (Urban Affairs Committee: 2/9/2010).

Even though many communities have begun planning for energy, requiring an energy section of the comprehensive plan does not seem to be common. Energy is not a required section of comprehensive plans in some of the most progressive states. New York statutes list fifteen components that plans may contain, (including utilities and infrastructure) but do not require communities to follow a fixed format for comprehensive plans (Otesego County Planning Department 2014). The state of Washington requires a utilities element in comprehensive plans. The utilities element consists of the general location, proposed location, and capacity of all existing and proposed utilities, including: electrical lines, telecommunication lines, and natural gas lines (Washington State Legislature 2014). In Colorado and South Carolina, energy is an optional element of a comprehensive plan (SCOE 2000, Colorado Department of Local Affairs 2014). In California and Oregon, communities are encouraged to incorporate energy throughout their comprehensive plans but the topic of energy does not need to be a separate section of the plan (Oregon Department of Land Conservation and Development 2014, State of California 2014).

Concerns

The League of Nebraska Municipalities spoke in a neutral fashion at the legislative hearings on LB 997. The League supported the idea of the bill but was concerned with two things: Would Nebraska have the expertise needed to write these energy elements? Would this cost communities a lot of money?

Voicing the concern of whether the communities and consultants would have the expertise to create the document, Lynn Rex of the League of Nebraska Municipalities stated, "one of our concerns is just to make sure that the expertise is there in cities across the state if this mandate does take effect" (Lynn Rex, Urban Affairs Committee: 2/9/2010). For most of the communities in Nebraska, this will be the first time they are directly addressing energy within their comprehensive plans. During the hearings, Mitch Paine suggested a few organizations that could help communities write the energy element including: the hundreds of LEED accredited professionals in Nebraska, the American Planning Association, and the University of Nebraska Planning program (Urban Affairs Committee: 2010).

The League of Nebraska Municipalities was also concerned with the funding necessary to create an energy element. "We don't know what...how much money it takes to do this sort of thing" (Lynn Rex, Urban Affairs Committee 2/9/2010). Despite the concern, it was believed this bill only adds a section onto something that communities are already required to do and would ultimately pay for itself through energy savings. "Imagine the millions of taxpayer dollars that could be saved" (Senator Mello, Urban Affairs Committee: 2/9/2010).

Although for smaller communities, coming up with the initial funding could be a struggle. Addressing these concerns Senator Mello stated, “I fully understand that a city of 800 might not have the funding or the additional funding that might be required or what they think is required to carry out this provision of their master plan. But that’s something that I’m more than willing to sit down and try to negotiate with Ms. Rex to find a solution that we can all get behind” (Senator Mello, Urban Affairs Committee: 2/9/2010).

This bill had wide support among state senators who believed the potential economic and environmental benefits outweighed the concerns of funding and necessary expertise. “I think in the long run it pays them dividends” (Senator Dubas, Floor Debate: 3/31/2010). The bill easily passed, forty-one to three, on April 9th, 2010 (Nebraska Legislature LB997).

The League of Nebraska Municipalities Energy Element Template

The League of Nebraska Municipalities created a template for communities to use when writing energy elements (Appendix C). The League created this template to help communities that have little to no money to pay consultants and do not have the expertise necessary to complete an energy element. This template, in my opinion, is grossly inadequate for the following reasons:

- The template does not include energy infrastructure.
- It does not encourage communities to establish energy goals or objectives
- It does not include multiple examples of substantial energy conservation measures

Further, in my opinion,

- It encourages a general statement of statewide facts, rather than encouraging action
- It encourages communities to state that data was not available

The energy element template by the League of Nebraska Municipalities helps small communities fulfill the requirements of LB 997, but I believe it will not result in any significant changes for the individual communities.

Chapter 4: Methodology

There have been a number of organizations that have created guides for writing an energy plan, including: the American Planning Association (APA), the U.S. Department of Energy (DOE), the National Renewable Energy Laboratory (NREL), and the South Carolina Energy Office (APA 2013, DOE 2013, NREL 2009, SCEO 2000). Using these guides, energy planning literature, and the requirements of LB 997, I have compiled twenty components of an ideal energy plan. Previous literature has used a point system to evaluate community energy plans (Mackres and Kazerooni, 2012). This study will use a similar approach to evaluate energy elements of local comprehensive plans in Nebraska.

Energy elements from eighteen Nebraska cities' and counties' comprehensive plans were selected for analysis of the twenty indicators of an ideal energy plan, as identified in literature and LB 997. Energy elements were selected because of their electronic availability and were obtained in the following ways: online through the communities' websites, through direct contact with communities, and through contact with private planning consulting firms. Additional energy elements were not available, and thus, are not included in this study. Of the selected energy elements, twelve are for cities and the remaining six are for counties. The jurisdictions with the selected energy elements have populations ranging from 908 citizens in Fort Calhoun to 258,379 citizens in Lincoln, according to the 2010 Census. The eighteen selected energy elements along with their corresponding jurisdictions are listed in Table 4.1.

Table 4.1: Selected Energy Elements

Jurisdiction	Plan Name	Year Plan Adopted
Cuming County	Cuming County Comprehensive Plan	2014
Fairbury	Fairbury, Nebraska Comprehensive Development Plan 2013	2013
Fillmore County	Fillmore County Comprehensive Plan 2013	2013
Fort Calhoun	Fort Calhoun Energy Element	2011
Fremont	Blueprint for Tomorrow	2012
Grand Island	Grand Island Energy Element	2014
Keith County	Keith County Energy Element	2014
Lexington	The Lex-Plan 2013	2013
Lincoln County	Lincoln County, Nebraska Comprehensive Plan Update 2012 to 2030	2012
Lincoln/Lancaster County	LPlan 2040	2011
Louisville	Louisville 2033	2013
McCook	McCook, Nebraska Comprehensive Plan	2013
Perkins County	Perkins County, Nebraska Comprehensive Plan 2013	2013
Ralston	Ralston 2034	2014
Sarpy County	Sarpy County Energy Element	2012
Sidney	Comprehensive Development Plan 2012	2012
Valentine	Valentine Comprehensive Plan	2014
Waverly	Comprehensive Plan 2013-2033	2013

Data Analysis

The selected energy elements have been examined for twenty indicators that are divided into seven categories: (1) public participation, (2) energy vision, (3) energy profile, (4) goals and objectives, (5) policies, strategies, and tools, (6) funding, and (7) implementation. The indicators of an ideal energy plan are listed in Table 4.2. Each indicator was identified in literature as a component of an ideal energy plan or a requirement of LB 997. The justification for each indicator is located in Appendix C. Four of the indicators are required within the language of LB 997: energy use by sector, utilization of renewable energy, current energy infrastructure, and conservation measures. The indicators required by LB 997 are highlighted within Table 4.2.

Table 4.2: Indicators Organized in Categories

Public Participation	Energy Vision	Energy Profile	Goals and Objectives	Policies, Strategies and Tools	Funding	Implementation
Steering committee	vision for the community's energy future	**energy use by sector**	reduce energy use	changes in zoning regulations	identify current/potential funding sources	assign lead entity in energy related activities
Community survey or other engagement strategies		renewable energy generation potential	increase renewable energy use	**conservation strategies**		timetable for implementing energy related measures
		utilization of renewable energy	improvements to energy infrastructure	public education		identify update schedule for plan
		current energy infrastructure	measurable goals	government focused actions		
		energy laws/policies				

*Highlighted indicators are required by LB 997

The energy elements were read and examined for the explicit presence of each indicator, as well as the implicit presence of each indicator by reading the context of the plan. It is important to be mindful of the context of the plan, as an indicator may be present even if it is not expressly shown through a heading or chapter. Each indicator was given a value of 1 if present or 0 if it is not present within the energy element. Values were added together to create a score. The energy elements were analyzed for: (1) differences among jurisdictions; (2) differences among the categories; (3) differences among the individual indicators; and (4) differences among LB 997 requirements. Jurisdictions could have a maximum score of twenty, because there are twenty indicators. Individual indicators and LB 997 requirements could have a maximum score of eighteen, because there are eighteen energy elements. Categories have different numbers of indicators within them, so the maximum score in a category is the number of indicators multiplied by eighteen. The scores are used to create percentages. Percentages are created by dividing the number of times the indicators are present by the number of opportunities for the indicators to be present. The percentage allows categories with different numbers of indicators to be easily compared. The analysis is organized using Microsoft Excel.

The results identify: (1) whether components of an ideal energy plan are included in Nebraskan energy elements; (2) whether energy elements include LB 997 requirements; (3) potential barriers to energy planning (i.e., the absence of energy use by sector in energy elements may be the result of the unavailability of data); and (4) opportunities for improvement.

Figure 4.1 shows the process that leads to the findings of this research. Literature and LB 997 identify the indicators of an ideal energy plan. The selected energy elements are examined for the identified indicators. The results of the analysis along with personal experience are used to derive the findings of this thesis.

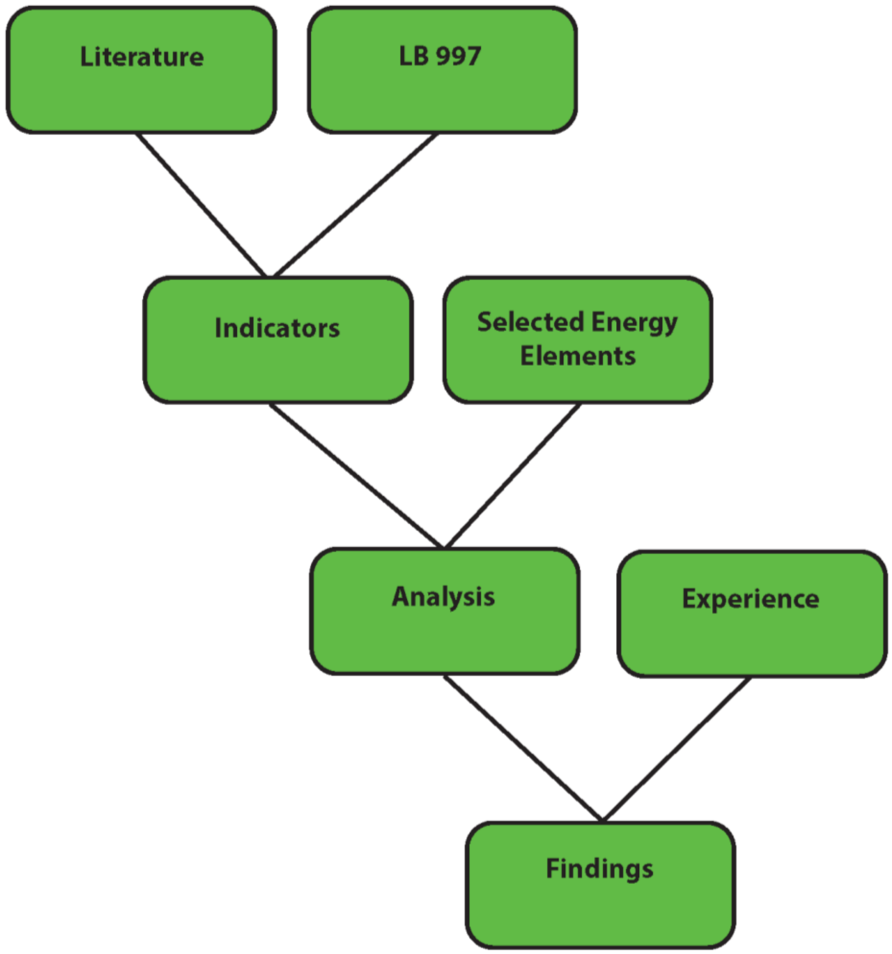

Figure 4.1 Thesis Process

Chapter 5: Results

This chapter identifies the findings of the energy element analysis. The spreadsheet displaying the energy element analysis is found in Appendix D. This chapter answers the following research questions: (1) Do Nebraska community energy elements include the components identified in literature? (2) Do Nebraska community energy elements include the components required by LB 997?

This chapter also lays the framework to answer the following research questions: (3) Are there barriers to the energy planning process? (4) How can the energy planning process be improved in Nebraska?

First, the eighteen selected energy elements were analyzed for the number of indicators present in each element. Figure 5.1 displays each jurisdiction’s score, which represents the number of indicators that are present within the jurisdiction’s energy element. The average number of indicators present within the eighteen energy elements is 11.5. This shows that the average energy element is missing just under half of the twenty components of an ideal energy plan, as determined by the review of literature. Fremont has the highest number of indicators present, with 17 out of 20. Ralston and Fillmore County have the fewest number of indicators present within the energy elements, with seven each. The size of the community does not seem to have a significant effect on the number of indicators present within the energy elements, nor does it seem to matter whether the energy element is for a city or county.

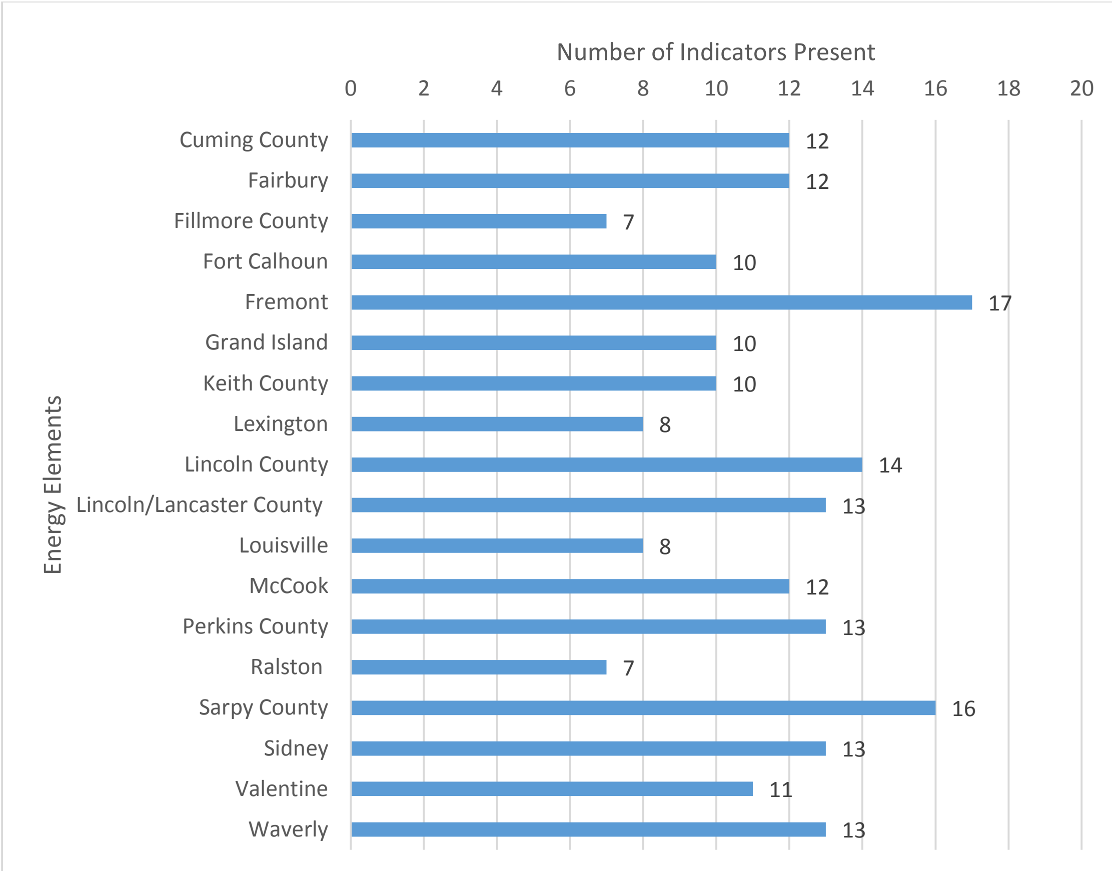

Figure 5.1 Number of Indicators Present within Energy Elements

Second, the categories of indicators were analyzed for their frequency within the eighteen energy elements. Table 5.1 shows the categories of indicators and the percentages of indicators that are present among all of the eighteen energy elements. The categories that are most fully represented by their respective indicators are Funding (77.8%), Energy Profile (74.4%), and Policies, Strategies and Tools (75.0%). Fourteen of the eighteen energy elements describe some form of incentive or funding opportunity. The three categories that are least present are Energy Vision (22.2%), Implementation (35.2%), and Goals and Objectives (40.3%). There is only one indicator in the category Energy Vision that appears in four of the eighteen energy elements, or only 22.2% of the time. The next least likely category to appear is Implementation. Implementation has three indicators that appear in 19 of the 54 opportunities, or 35.2%. Public Participation is present in only 55.6% of the opportunities.

Table 5.1 Categories of Indicators Present within the Energy Elements

Category	Indicators in Category	Present/Possible	Percent
Public Participation	2	20/36	55.6%
Energy Vision	1	4/18	22.2%
Energy Profile	5	67/90	74.4%
Goals and Objectives	4	29/72	40.3%
Policies, Strategies and Tools	4	54/72	75.0%
Funding	1	14/18	77.8%
Implementation	3	19/54	35.2%

Third, the twenty individual indicators were analyzed for their frequency in the eighteen energy elements. Figure 5.2 shows the number of plans in which individual indicators were present. The most present indicator is Conservation Strategies. Energy Conservation Strategies are present in all eighteen of the energy elements analyzed. The indicators Energy Laws and Policies, and government focused actions were frequently present, as they were in 17 of the 18 plans. Many of the indicators identified by literature were frequently missing in the energy elements. Seven of the twenty indicators were in six or fewer of the plans. Measurable Goals were only present in two of the 18 plans. Although the Policies, Strategies, and Tools category was present in 75% of the opportunities, the indicator Public Education appeared in only one-third of the energy elements.

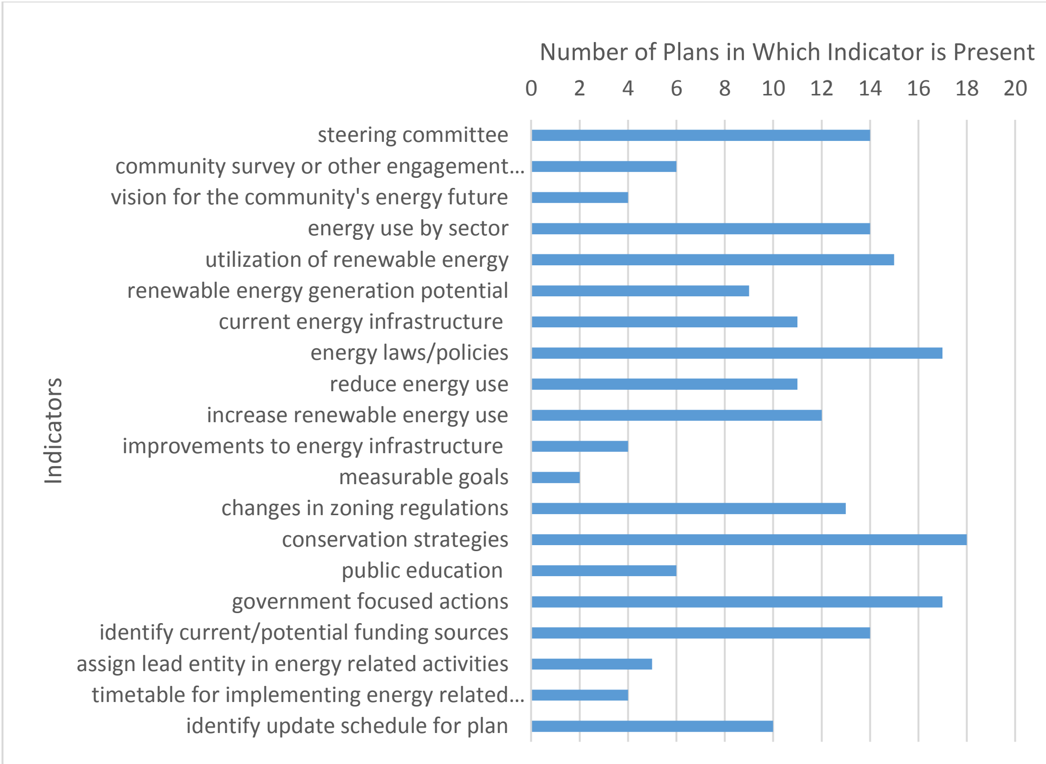

Figure 5.2 Number of Plans in Which Indicators Were Present

Fourth, the indicators required by LB 997 were analyzed for their frequency within the energy elements, seen in Table 5.2. All of the energy elements include some form of Conservation Strategies. However, the remaining indicators required by LB 997 are missing in some energy elements. Energy Use by Sector is included in only 14 of the 18 energy elements. Of the 14 energy elements that did include Energy Use by Sector, only 10 include local data. Three of the energy elements describe how energy is used in different sectors, instead of how much energy is used by sector. Only 11 of the 18 energy elements include Energy Infrastructure. Three energy elements do not address Utilization of Renewable Energy.

Table 5.2 LB 997 Requirements Present Within the Energy Elements

Category	Present/Opportunities
energy use by sector	14/18
utilization of renewable energy	15/18
current energy infrastructure	11/18
conservation strategies	18/18

Chapter 6: Discussion and Conclusions

This chapter discusses the significant findings of this study using the results from the previous chapter. After discussing the findings and their implications, recommendations to improve the energy planning process in Nebraska are presented.

Do Nebraska Community Energy Elements Include the Components Identified in Literature?

Nebraska community energy elements are missing several of the indicators identified in literature. These indicators were identified in literature as components of an ideal energy plan or as best practices. However, the most important indicators to an energy element that are missing include: Public Participation, Measurable Goals, Public Education, and Implementation. These indicators and categories described in the following subsections are essential in order to invoke action. Many of the energy elements studied appear to be collections of factual statements rather than plans that will guide the communities towards action. This is shown through the results of this study. Energy Profile indicators, which state current conditions, are present in 74.4% of opportunities for those indicators to appear in the eighteen energy elements studied. Conversely, indicators from the categories Goals and Objectives, and Implementation are present in 40.3%, and 35.2% of opportunities, respectively. The absence of the categories and indicators within Nebraska community energy elements discussed in the following sections, suggests that the energy elements studied in this research may not lead to meaningful action.

Public participation

It is clear that public participation is not a priority of the energy elements as the Public Participation indicators are present in only 55.6% of the opportunities for those indicators to appear and only one-third of the energy elements indicate that a survey or other engagement strategies are used. One of the possible reasons that public participation is not used more frequently is the expense. Public engagement strategies, such as a survey or workshop, can significantly increase the cost of preparing an energy element. In an informal conversation, a community representative mentioned that his community would prefer to keep costs low and quickly fulfill the requirements of LB 997, even if there is limited public participation.

However, the planning process cannot be carried out in a vacuum. “Direct citizen involvement in the preparation of plans is the best way to accurately assess community problems and needs” (SCEO 2000). Without public participation, the energy elements may not fit the community needs and may increase public opposition for future energy projects. Research has shown that energy projects with higher rates of public participation have a higher likelihood of success (Doris et al. 2009).

Measurable Goals

Measurable goals set a target for the community to achieve and establish a way to assess whether or not a goal has been met. Measurable goals are included in energy planning guides (Mackres and Kazerooni 2012, DOE 2013) because they allow a community to track their progress and inspire action. I have been told in informal conversations with both consultants and community representatives that many communities do not want to set measurable goals out of fear that they will not meet them. Measurable goals was the least present indicator within the study, appearing in only two of the eighteen energy elements.

Public Education

Successful energy conservation strategies are dependent on the participation of individual citizens (SCEO 2000). Educating the public on the goals of the energy element and meaningful conservation measures will inspire citizens' participation and provide benefits for the community, as well as the individual citizen. Public education may also garner public support for energy projects. Despite its value, public education was mentioned in only six of the eighteen energy elements studied.

Implementation

Implementation is the key to realizing the vision, goals, and strategies of a plan (DOE 2013). Identifying an implementation strategy turns the energy element into reality; however, Implementation was present in only 35% of the opportunities for it to appear in the studied energy elements. In an informal conversation with a planning consultant, I was told that most communities do not want to include specific implementation strategies and that energy elements are more easily adopted without them. This observation was confirmed in my own experiences at planning commission and city council meetings. I am commonly asked in community meetings what actions are required by the community if they adopt the energy element. It appears communities are more comfortable adopting an energy element that serves as a general guidance document than an energy element that identifies specific implementation actions.

Five of the eighteen energy elements assigned a lead entity in energy related activities. Assigning a lead entity in energy related activities establishes accountability for the implementation of the energy plan (Mackres and Kazerooni 2012). Without holding an entity accountable, community staff will be unclear as to their responsibilities regarding the implementation of the energy element.

Only four of the eighteen energy elements established a timetable for implementing energy related measures. A timetable allows a community to determine whether they are on track to achieve their energy goals. A timetable can also help prioritize funding (Mackres and Kazerooni 2012).

Do Nebraska Community Energy Elements Include the Components Required by LB 997?

The most surprising result of this study is that, with the exception of conservation measures, the indicators required by LB 997 were not present in all of the energy elements. The consequences of not fulfilling the requirements of LB 997 are potentially drastic. In an informal conversation with a community representative, I was told if a community does not adopt an energy element, their comprehensive plan may be deemed invalid, and thus, the community would lose the power of zoning. If a community does not include a portion of the energy element required by state law, it is reasonable to assume that compliance of the comprehensive plan with statutory requirements may be compromised if challenged in court.

Energy Use by Sector

As mentioned in the previous chapter, energy use by sector is present in only 14 of the 18 energy elements analyzed, and only 10 of the 18 use local data. This indicates that acquiring local energy use data is difficult. In my personal experience, acquiring local energy use data can be difficult for a number of reasons. The jurisdictions of energy providers do not follow political boundaries, so providers may not be able to determine the exact energy use data for a specific community. Gathering energy use data from a county can be especially difficult. Counties may have five different electricity providers. Electricity providers frequently have different ways of measuring use, including kilowatt-hours, British thermal units, or expenditures. Electricity providers also categorize sectors differently. For example, some providers will separate municipal and irrigation energy use into separate categories, and some providers will combine them with the residential or commercial sectors. These difficulties lead some communities to use statewide energy use data in order to fulfill LB 997 requirements.

Utilization of Renewable Energy Sources

Utilization of renewable energy is missing in three of the eighteen energy elements examined in this study. It is possible that these communities are not currently utilizing renewable energy, but it is not explained within their respective documents. Discovering the utilization of renewable energy can be difficult if someone does not know where to look. One source of data is the reports that electricity providers are required to write regarding the renewable energy generation within their jurisdiction. The three energy elements that are missing the utilization of renewable energy include the potential of wind and solar energy. The writers may have been confused as to the requirements of LB 997 and thought that the potential for use of renewable energy would have fulfilled the requirement.

Energy Infrastructure

Energy infrastructure is present in only 11 of the 18 energy elements. Many of the energy elements missing infrastructure summarize the requirements of LB 997 within the document. After informal conversations with other consultants, I believe this is due to confusion regarding what is required. Energy infrastructure is missing in the League of Nebraska Municipalities' template. If consultants used the League of Nebraska Municipalities template, they may have assumed energy infrastructure was not a requirement. Another factor may be the difficulty of acquiring data. The specific locations of transmission lines and pipelines are not publicly available due to security reasons. The Nebraska Power Review Board, which oversees public power districts (PPDs), requires PPDs to regularly review infrastructure (NPA 2012). This report may be a good source for communities to evaluate their energy infrastructure. Communities and consultants should also contact their utility providers for energy infrastructure data. Utility providers must regularly evaluate their infrastructure to respond to energy demands.

The Problem with LB 997

I believe the largest problem regarding the legislation enacted by LB 997 is the confusion with what is required. The League of Nebraska Municipalities template (Appendix B) is intended to outline the basic requirements of the law in order for a community to comply with the law in an inexpensive way. As it did not include energy infrastructure, I do not believe the template accomplished its goal. It would be helpful if the state outlined an interpretation of what is specifically required within the law. If the state would do this, communities and consultants would be more likely to understand the requirements fully.

Are There Barriers to the Energy Planning Process?

I have discovered a few barriers to successful energy planning in Nebraska through this study and my personal experience. These barriers include: lack of education, community opposition, difficulty acquiring data, and costs.

Education

The lack of education regarding energy is a barrier to accomplishing good energy planning facilitated by consultants, as well as planning pursued solely by the communities. Most of these consultants and communities have never considered energy in their comprehensive plans before and may not have the expertise to write an energy element. This concern was voiced during the legislative hearings on LB 997 by the League of Nebraska Municipalities (Urban Affairs Committee: 2/9/2010). In order to effectively plan for energy, communities and consultants have to understand: the importance of energy planning, the barriers energy planning faces, and the components of an effective energy plan. As mentioned earlier, in 2001, only 12% of the U.S. public could pass a basic quiz on energy (Monroe and Oxarart 2010). The absence of the indicators that were identified in literature within the community energy elements examined in this study suggests that Nebraska communities and the consultants that serve them need to be educated on how to create an effective energy element.

Community Opposition

In my experience writing energy elements, I have noticed many communities seem apathetic or even resistant towards energy elements. LB 997 was an unfunded mandate in the eyes of many communities. Many communities have not written a full update of their comprehensive plan in the last 5 years, so they have needed to amend it with a separate energy element. Some community representatives hate the idea that they are forced into adopting something that they do not feel is important, nor will be used. A planning commissioner once told me during a meeting that, "it's a shame that someone took a lot of time to put this document together because it will never be used." This statement highlights the largest barrier to effective energy planning in Nebraska: community opposition. If energy planning is not viewed as an important process to prepare for the future of a community, it will likely be underfunded and ineffective.

Data

As mentioned previously, it can be difficult to acquire local data regarding energy use and infrastructure. Another area in which it is difficult to acquire data is the renewable energy potential for a community. Only nine of the eighteen energy elements examined identify the renewable energy potential for the local area. The most common form of renewable energy potential analyzed in Nebraska energy elements is wind speed. In my personal experience, purchasing local wind speed data from a private company can cost thousands of dollars. Most communities will not be willing to spend that much for detailed data. Instead, communities and consultants have had to rely on less accurate, generalized data.

Costs

The cost of writing an energy element was a concern of the League of Nebraska Municipalities during the legislative hearings for LB 997. Communities will not want to spend a lot of money to pay consultants to write an energy element, if communities do not believe the energy element is important, nor think that it will be used. If the budget for an energy element is tight, consultants will have to cut some components or spend less time on components in order to make money on the project.

The cost of energy is another barrier to Nebraska energy planning. Public power districts have done a great job in providing reliable and low cost energy for the residents of Nebraska. Since the cost of energy is relatively low, there is no perceived problem. If there is no perceived problem, there may be less urgency among communities to take action.

How Can the Energy Planning Process Be Improved in Nebraska?

Education

Educating consultants, elected officials, and the general public on the importance of energy planning, as well as the many benefits that a community can enjoy from energy planning, will improve the quality of energy plans in Nebraska. Through education, communities can also understand how high-quality energy plans pay for themselves. The Nebraska Energy Office should continue to educate the state regarding energy planning.

Another strategy that would improve energy planning within the state would be to create a guide to writing energy elements. Through both the results of this study and my personal experience, it is clear that Nebraska communities and consultants are confused as to what specifically is required in energy elements under LB 997. This guide could educate those writing energy elements by explaining: the importance of energy planning, the unique opportunities in Nebraska, what is required under the law, and best practices in energy planning.

Work with Utility Providers

Communities and consultants should work with utility providers and involve them within the energy planning process. Utility providers can provide valuable data and may be a potential funding source. As mentioned in the literature review chapter, it is in the utility providers' best interest to improve energy efficiency. Increasing energy efficiency reduces the need for added energy generation and costly infrastructure improvements. Partnering with utility providers and creating shared goals benefits both parties.

Implications for Communities in Nebraska

The results of this study suggest that most energy elements of local comprehensive plans in Nebraska are compilations of general facts, rather than documents that guide action. The absence of the components of an ideal energy plan will likely lead to communities being unable to receive the benefits associated with energy planning that were identified in the literature review. The absence of LB 997 requirements within energy elements not only limits the quality of these plans, but may also lead to the comprehensive plans being compromised. These energy elements are the first attempts for cities and counties in Nebraska to incorporate energy into their comprehensive plans, and there are many opportunities for improvement.

Implications for the Energy Planning Profession in Nebraska

This research identifies the ideal components of an energy plan and highlights why these components are important to the energy planning process. Incorporating these components allows energy planning professionals to engage in an effective energy planning process. This research also identifies the barriers to energy planning so that professionals can create strategies to effectively overcome those barriers. Lastly, this thesis identifies opportunities to improve energy elements in Nebraska. This research will lead communities and consultants to create higher quality energy elements that will ultimately result in a more sustainable Nebraska.

Limitations

One limitation of this study is the small sample size of energy elements. The selected energy elements were chosen by electronic availability through communities and private planning firms. This research would have benefitted from the availability of additional energy elements. The small sample size of the study may not reflect all energy elements throughout the state.

Another limitation is that this study focused solely on the components that were present within the energy elements, not the quality of the components. Future research should examine the quality of the energy elements in relation to the energy measures implemented within the communities.

A third limitation is that this study only examined the energy elements as stand-alone documents, not the entire comprehensive plan. If it was clear that an indicator was in a separate part of the comprehensive plan, an effort was made by the author of this study to analyze that section of the comprehensive plan. However, it is possible that indicators were located elsewhere in the comprehensive plan and were not counted.

Appendix A: LB 997

Legislative Bill 997 amended Nebraska state statutes sections 15-1102, 19-903, and 23-114.02 relating to comprehensive plans of counties and cities. Villages are exempt from the amendments.

Section 1. 15-1102, When a city of the metropolitan class adopts a new comprehensive plan or a full update to an existing comprehensive plan on or after the effective date of this act, but not later than January 1, 2015, such plan or update shall include, but not be limited to, an energy element which: Assesses energy infrastructure and energy use by sector, including residential, commercial, and industrial sectors; evaluates utilization of renewable energy sources; and promotes energy conservation measures that benefit the community.

Section 2. 15-1102 (Regarding cities of the primary class), When a new comprehensive plan or a full update to an existing comprehensive plan is developed on or after the effective date of this act, but not later than January 1, 2015, an energy element which: Assesses energy infrastructure and energy use by sector, including residential, commercial, and industrial sectors; evaluates utilization of renewable energy sources; and promotes energy conservation measures that benefit the community.

19-903, When a new comprehensive plan or a full update to an existing comprehensive plan is developed on or after the effective date of this act, but not later than January 1, 2015, an energy element which: Assesses energy infrastructure and energy use by sector, including residential, commercial, and industrial sectors; evaluates utilization of renewable energy sources; and promotes energy conservation measures that benefit the community. This subdivision shall not apply to villages;

23-114.02 (Regarding counties), When a new comprehensive plan or a full update to an existing comprehensive plan is developed on or after the effective date of this act, but not later than January 1, 2015, an energy element which: Assesses energy infrastructure and energy use by sector, including residential, commercial, and industrial sectors; evaluates utilization of renewable energy sources; and promotes energy conservation measures that benefit the community.

Appendix B: League of Nebraska Municipalities Energy Element Template

Comprehensive Plan Energy Development

In the last couple months, the League has received a number of requests for a Comprehensive Plan Energy Plans. The history of this requirement goes back to the 2010 Legislative session when the Legislature adopted LB 997 which required that a City comprehensive plan include the following new element before January 1, 2015:

When a new comprehensive plan or a full update to an existing comprehensive plan is developed on or after July 15, 2010, but not later than January 1, 2015, an energy element which: Assesses energy infrastructure and energy use by sector, including residential, commercial, and industrial sectors; evaluates utilization of renewable energy sources; and promotes energy conservation measures that benefit the community. ***This subdivision shall not apply to villages****;*

This requirement is codified within Neb. Rev. Stat. 19-903.

In 2010, the League sent the following model to Nebraska cities. This model was developed with the assistance of Nebraska's public power utilities. A City can include this language in their Comprehensive Plan. Please forward this information to the City Zoning Department since many of them are not on the Utilities Section mailing list.

MODEL
COMPREHENSIVE DEVELOPMENT PLAN
ENERGY ELEMENT

1. Energy infrastructure and energy use by sector, including residential, commercial, and industrial sectors:

The Nebraska Energy Office compiles statistics on energy consumption in the state by sector. The latest statistics are from 2007.

Residential: In 2007, 47.5 % of the residential sector's energy usage was from natural gas. 40.2% of the energy consumed in the residential sector was electricity, 7.7 % were petroleum products, 4.9 % was renewable energy (wood 4.38%, geothermal 0.22%, and solar 0.04%), and less than 1% was coal. [Source: Nebraska Energy Office, "Energy Consumption in Nebraska's Residential Sector," www.neo.gov/statshtml/09/html]

Commercial: In 2007, 48.06% of the commercial sector's energy usage was from electricity and 45.88% from natural gas. Petroleum products made up 4.1 % of the energy consumed in the commercial sector (diesel fuel 1.65%, propane 1.58%, motor gasoline 0.88%, kerosene 0.01%), 1.8 % was renewable energy (geothermal 0.92%, wood 0.85%, and ethanol 0.02%), and less than 1% was coal. [Source: Nebraska Energy Office, "Energy Consumption in Nebraska's Commercial Sector," www.neo.gov/statshtml/12/html]

Industrial: In 2007, 38.13% of the industrial sector energy usage was from natural gas, 22.66% from diesel fuel, and 19.77% from electricity. Petroleum products other than diesel fuel were asphalt and road oil (3.82%), propane (3.51%), motor gasoline (2.33%), residual fuel (0.19%), lubricants (0.14%), kerosene (0.01%), and other petroleum (0.88%). 5.13% of the energy consumed in the industrial sector was coal and 3.44% was renewable energy (Wood and wood waste 3.38% and ethanol 0.06%). [Source: Nebraska Energy Office, "Energy Consumption in Nebraska's Industrial Sector," www.neo.gov/statshtml/15/html]

The city should choose the appropriate paragraph:

Energy infrastructure and energy use statistics by sector are not available for the City of ______________.

OR (If local energy consumption statistics are available)

Energy infrastructure and energy use by sector for in the City of ______________ is as follows:

2. Utilization of renewable energy sources:

The Nebraska Energy Office reports that in 2007, three percent of Nebraska's energy consumption was from renewable energy sources. The sources of energy for Nebraska in 2007 were petroleum (33%), coal (31%), natural gas (21%), nuclear power (17%) and renewable energy (3%). The renewable sources were biomass (1.48%), conventional hydroelectric power (0.496%), ethanol (0.379%), wind (0.309%), geothermal energy (0.115%), and solar (0.005%). [Source Nebraska Energy Office, "Nebraska's Renewable Energy Consumption," www.neo.ne.gov/statshtml/92.htm]

The nation as a whole used a higher percentage of renewable energy than Nebraska. In 2008, 7% of the energy consumption in the United States was from renewable sources. That year the sources of energy for the nation were petroleum (37%), natural gas (24%), coal (23%), nuclear electric power (8%), and renewable energy (7%). The sources of renewable energy were solar (0.07%), geothermal (0.35%), wind (0.49%), hydropower (2.38%), and biomass (3.71%). [Source: U.S. Energy Information Administration, "Renewable Energy Trends in Consumption and Electricity," www.eia.doe.gov/cneaf/solar.renewables/page/trends/rentrends.html]

The city should choose the appropriate paragraph:

Renewable energy source statistics are not available for the City of ______________.

OR (If local renewable energy statistics are available)

The renewable energy sources used in the City of ________________ are as follows:

3. Energy conservation measures that benefit the community.

a. Energy Codes – Under §§81-1608 to 81-1616, the State of Nebraska has adopted the International Energy Conservation Code as the Nebraska Energy Code. Any city may adopt and enforce the Nebraska Energy Code or an equivalent energy code. If a city does not adopt an energy code, the Nebraska Energy Office will enforce the Nebraska Energy Code in the jurisdiction.

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, or 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.

The city should choose the appropriate paragraph:

The City of ________________ adopted the Nebraska Energy Code on [date].

OR

The City of ________________ has not adopted an energy code. If a city or county does not adopt an energy code, the Nebraska Energy Office will enforce the Nebraska Energy Code in the jurisdiction.

The cities, villages, and counties that have adopted the Nebraska Energy Code or an equivalent can be found at the Nebraska Energy Office web site at:
http://www.neo.ne.gov/home_const/iecc/iecc_codes.htm

b. Energy Efficiency Programs – The City will work with utility companies that supply energy to the residents and businesses of the City to promote and implement energy efficiency programs that can be utilized by these customers to improve conservation and utilization of electricity, natural gas, and other energy sources.

Residents and businesses are encouraged to work with the utility companies and take advantage of the companies' energy efficiency programs to improve conservation and utilization of electricity, natural gas, and other energy sources.

c. "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 City and residents and businesses in the City are encouraged to take advantage of the conversation measures.

d. City may add other conservation measures. One suggestion is to include planting trees by communities. Cities that have been designated Tree City USA cities are providing energy efficiency/conservation options by planting trees.

Appendix C: Justification for Indicators

Public Participation

1. Steering committee/leadership team- This is the first step in the Department of Energy's (2013) guide to strategic energy planning. A steering committee or leadership team will maintain focus on the energy planning process, motivate stakeholders, and ensure its completion over time (DOE 2013). Establishing a leadership team is a step in NREL's guide for developing an energy plan (NREL 2009).

2. Community survey or other engagement strategies- The planning process cannot be carried out in a vacuum. "Direct citizen involvement in the preparation of plans is the best way to accurately assess community problems and needs" (South Carolina Energy Office, 5). The inclusion of stakeholders is a critical step to a successful energy plan (NREL 2009). Renewable energy projects with higher rates of public participation in the decision making process have been shown to have a higher likelihood of success (Doris et al. 2009).

Energy Vision

3. Vision statement- a vision statement offers a representation of what a community wants to look like in the future. This vision provides a focus for the rest of the work that will go into an energy plan. An energy vision statement is included in the Department of Energy's guide to writing a comprehensive energy strategic plan (DOE 2013). Developing an energy vision is a step in NREL's guide for developing an energy plan (NREL 2009). A well-articulated vision statement is a broad sentence or set of sentences that can guide an overall process (NREL 2009).

Energy Profile

In order to establish goals and strategies, a community must first know its current conditions.

4. Energy use by sector- Examining energy use by sector allows the communities to not only establish a baseline from which to set goals, but it also allows the communities to develop strategies specific to that sector. "Understanding energy use at the community level helps to clarify which programs and projects will fit the needs of the city" (NREL 2009). Identifying energy use by sector is also a requirement of LB 997. An energy baseline includes all relevant sectors (NREL 2009). An inventory of current usage includes consumption characteristics within each sector (SCEO 2000).

5. Utilization of renewable energy sources- Identifying utilization of renewable energy sources is a requirement of LB 997. Examining utilization of renewable energy sources

helps a community determine if action is needed to increase renewable energy production.

6. Renewable energy generation potential- Establishing potential renewable energy sources will guide the community in developing policies, programs, and incentives specific to the energy source. For example, if there are minimal wind resources in the area, the community would not bother to examine the height restrictions of their zoning code to encourage wind turbines. Assessing local renewable energy potential is a step in creating an energy element (SCEO 2000).

7. Energy infrastructure- Identifying the current energy infrastructure is critical in order to determine if current systems are adequate for current and future energy demands. Identifying energy infrastructure is also a requirement of LB 997.

8. Energy laws/policies- Identifying current laws, regulations, and policies is important to provide context to the planning effort, and also to determine whether they need to be adjusted due to the community's goals. Planning laws and zoning regulations can greatly inhibit renewable energy development (Doris et al. 2009).The energy element may require revisions to existing ordinances and regulations such as the zoning ordinance or land development regulations (SCEO 2000).

Goals and Objectives

Informed by the profile, and guided by the vision statement, goals and objectives identify what the community wants to accomplish with the energy plan.

9. Reduce energy use- This is a common goal among energy plans because it allows communities to use the current energy supply longer, as well as accomplish economic and environmental goals (SCEO 2000). Energy conservation was one of the two common themes I found in reviewing energy planning literature.

10. Increase renewable energy use- This is a common goal because it may parallel other community goals, such as reducing greenhouse gas emissions from fossil fuels, which has been linked to climate change and air pollution. Renewable energy production also mitigates the effects of fluctuating fossil fuel prices. Increasing renewable energy generation was one of the two common themes I found in reviewing energy planning literature. Developing local renewable energy resources increases the diversity of energy supplies while strengthening the local economy (SCEO 2000).

11. Energy infrastructure- Improving energy infrastructure increases the reliability and efficiency of the energy system and ensures that the system will be adequate for future needs. Identifying energy infrastructure is a requirement of LB 997.

12. Measurable goals- Creating measurable goals is included in Mackres and Kazerooni's (2012) review and the DOE (2013) guide to community energy planning. Measurable

goals set targets for the community to achieve and ensure there is a way to assess whether the goals have been met.

Policies, Strategies, and Tools

Policies, strategies, and tools articulate the approaches a community will use to realize their goals.

13. Changes in zoning regulations- Zoning regulations may unnecessarily restrict renewable energy development or conservation efforts (Doris et al. 2009). Zoning regulations are something that planners and decision makers have the ability to change. An important component of energy planning is accomplished through the revision of regulatory policies that are barriers to quality, balanced growth (SCEO 2000).

14. Conservation strategies- Conservation strategies provide the framework for how the community is going to reduce its energy use. Conservation measures are required by LB 997. Energy conservation/efficiency strategies are the focus of all energy plans (SCEO 2000, NREL 2009, DOE 2013).

15. Public education- A community will not be able to achieve its energy goals without the help of its citizens. Educating the public regarding energy related issues will provide benefits for the community as well as the individual citizen. Successful energy conservation strategies are dependent on the participation of individual citizens (SCEO 2000). The public needs to know how energy policies can benefit both individuals and the community as a whole (SCEO 2000).

16. Government focused actions- The local or county government should set an example for its community. The EPA's Clean Energy-Environment Guide to Action (2006) states that incorporating renewable energy into public projects can provide significant energy savings for governments and create a market for renewable energy while promoting the implementation of renewable energy in the public and private sectors. By making energy conservation a visible priority in policies and procedures, local governments can lead by example (SCEO 2000).

Funding

17. Funding sources- Identifying funding will create greater support and increase the likelihood that community goals will be met (DOE 2013). Identifying funding sources is a step in NREL's guide for developing an energy plan (NREL 2009).

Implementation

18. Assign lead entity in energy related activities- Assigning a lead entity will establish accountability for the implementation of the energy plan (Mackres and Kazerooni, 2012). The plan should include a listing of the individuals, jurisdictions or agencies that will participate in the implementation process (SCEO 2000).

19. Timetable for implementing energy related measures- A timetable will allow a community to determine whether they are on track to achieve their energy goals. It can also create more support for projects and help with funding (Mackres and Kazerooni, 2012). The energy element must include time frames for completion (SCEO 2000).

20. Identify update schedule for plan- The ideal planning process is never complete. Instead it is constantly in the process of refinement and revision (Mackres and Kazerooni, 2012). "Periodic evaluation is necessary to ensure that measurable impacts are being realized and to determine where modifications are needed" (SCEO 2000).

Appendix D: Indicator Analysis

	Cuming County	Fairbury	Fillmore County	Fort Calhoun	Fremont	Grand Island	Keith County	Lexington	Lincoln County	Lincoln/ Lancaster County	Louisville	McCook	Perkins County	Ralston	Sarpy County	Sidney	Valentine	Waverly	**Total**
Public Participation																			
Steering committee	1	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	**14**
Community survey or other engagement strategies	1	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	0	0	**6**
Energy Vision																			
vision for the community's energy future	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	**4**
Energy Profile																			
energy use by sector	1	1	1	1	0	1	0	1	0	1	1	1	0	1	1	1	1	1	**14**
utilization of renewable energy	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	**15**
renewable energy generation potential	1	1	0	1	0	1	1	0	1	0	0	0	1	0	1	1	0	0	**9**
current energy infrastructure	0	0	1	1	1	1	1	0	1	0	0	1	1	0	0	1	1	1	**11**
energy laws/policies	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	**17**
Goals and Objectives																			
reduce energy use	0	1	0	1	1	1	1	0	1	1	0	0	1	0	1	1	0	1	**11**
increase renewable energy use	0	1	0	1	1	1	1	0	1	1	0	1	1	0	1	1	0	1	**12**
improvements to energy infrastructure	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	**4**
measurable goals	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	**2**
Policies, Strategies and Tools																			
changes in zoning regulations	0	1	1	1	1	1	1	0	1		1	1	1	0	1	1	0	1	**13**
conservation strategies	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**18**
public education	0	0	0	0	1	0	0	0	1	1	0	1	0	0	1	0	0	1	**6**
government focused actions	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	**17**
Funding																			
identify current/potential funding sources	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	**14**
Implementation																			
assign lead entity in energy related activities	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	0	**5**
timetable for implementing energy related measures	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	**4**
identify update schedule for plan	1	1	0	0	1	0	0	0	1	1	0	0	1	1	0	1	1	1	**10**
Total	**12**	**12**	**7**	**10**	**17**	**10**	**10**	**8**	**14**	**13**	**8**	**12**	**13**	**7**	**16**	**13**	**11**	**13**	

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