Public Power: Is It Still Affordable?

Platte INSTITUTE for economic research

The Costs and Benefits of Public Power in Nebraska: An Investigation of Electricity Rates, Taxes, and Competitiveness

Produced for the Platte Institute for Economic Research
December 28, 2015

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Preface

The Costs and Benefits of Public Power in Nebraska: An Investigation of Electricity Rates, Taxes, and Competitiveness

In April of 2015, the Platte Institute for Economic Research commissioned this study. The goal of the study was to examine, analyze and report on the public power industry in the state of Nebraska to determine the cost and benefits to taxpayers, consumers, and businesses in Nebraska.

This project, while funded by the Platte Institute for Economic Research, was developed independently of this organization. Any conclusions, findings, errors or misstatements are solely the responsibility of Goss & Associates.

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Goals of the study

Specific goals of the study are to:

1. Compare Nebraska's electricity rates provided relative to that supplied by private producers in other states, incorporating both direct and indirect subsidies furnished to the comparable units.
2. Investigate best practices and potential future opportunities that are, or might be, restricted under the current public power arrangements in Nebraska.
3. Establish a better understanding of the long-term implications of tax advantages provided to the public power industry and how those tax advantages affect the taxpayer and the state's overall competitive environment for consumers, taxpayers and businesses in the state.

Key Findings

The Costs and Benefits of Public Power in Nebraska: An Investigation of Electricity Rates, Taxes, and Competitiveness

I. General

- Public power companies provided electricity service to more than 2,000 communities across the nation in 2015. Supporters argue that the significant benefits of public power are due to local ownership and lower costs. Without a required profit margin, along with tax-exempt financing, which is priced at below market interest rates, public power entities are able to pass savings along to electricity consumers. In addition, public utilities are exempt from paying income and property taxes, which proponents claim also lowers rates.
- The legislative environment in Nebraska poses barriers to independent and private investment in the state. Nebraska's public power monopoly discourages private investment in new power generation because private companies are unable to enter into power purchase agreements, which would enable development.
- The cost to produce electricity in Nebraska depends considerably on the prices of fuel used in generation. Statewide, Nebraska relies heavily on coal as the primary source of fuel. Therefore, electricity rates correlate with coal prices in the market. Coal has been a relatively cheaper source of fuel for Nebraska due to the state's proximity to a large coal supply from Wyoming's Powder River Basin.
- Despite rapid declines in natural gas prices due to advanced extraction techniques, it represents less than 1.5 percent of input fuel for Nebraska electricity producers. The drop in natural gas prices has significantly lowered wholesale electricity prices, reducing the profits that Nebraska's utilities used in the past to help keep rates low. Profits generated from wholesale sales have historically helped subsidize rates for Nebraska's consumers.

II. Higher and Rapid Growth in Nebraska Electricity Prices

- Recent data show that Nebraska's electricity rates in Nebraska have grown at a much faster pace than in other states. Consequently, Nebraska no longer delivers electricity to the consumer at a rate below competitor states.
- Nebraska's overall electricity prices are projected to rise from 103.6 percent of the West North Central (WNC)[2] median in 2013 to 106.7 percent in 2018.
- Nebraska's electricity prices have grown from 96.2 percent and 67.6 percent of the 2008 regional and national medians to 103.6 percent and 95.9 percent of the 2013 medians, respectively. (Figure 1.1)
- The shutdown and recovery of the Fort Calhoun Nuclear Generating Station was a significant driver of Nebraska's rapid growth in electricity prices beyond 2011. Recommissioning ultimately cost ratepayers an estimated $177 million,[3] which is approximately 18 percent of OPPD's yearly operating expenses.[4] (Figure 5.1)

Key Findings

III. Nebraska's Volatile Electricity Prices

- Electricity price data between 2005 and 2014 show that Nebraska's volatility in overall electricity prices was the highest in the WNC region and 45.4 percent above the regional average.
- Calculations indicate that residential and industrial electricity rates for Nebraska were much more volatile than for any other state in the WNC region. Nebraska also had the greatest industrial electricity price volatility among all U.S. states.

IV. Higher Industrial Rates and Economic Development

- Nebraska's average industrial rates have trended upward over the past decade, surpassing and remaining above the national average since 2012. (Table 3.1)
- Nebraska's 2014 industrial electricity rate of 7.30 cents per kWh exceeded both the WNC median of 7.04 and the U.S. industrial rate of 7.01. (Figure 1.2)
- For 2014, Nebraska ranked in the top half of WNC states in terms of overall competitiveness of its residential rates, but in the bottom half in commercial and industrial rates. Only North Dakota and Kansas have industrial electricity rates higher than Nebraska. (Table 2.1).
- From 2005 to 2014, Nebraska had the second highest annual growth in industrial electricity rates in the region with an annual growth more than double that of the nation. Additionally, Nebraska had the greatest industrial electricity price volatility among all comparison WNC states and the median U.S. state. (Table 3.2)
  - This is a consideration for economic development because it renders Nebraska a less attractive state for industrial growth, and is contrary to optimum electricity pricing strategies.
  - Nebraska's climbing industrial rate has restrained the state's economic growth.[5] (Figure 3.1)
  - Energy costs are a sizeable business and farm expense. As such, the state's industrial rate influences the profitability of firms and incentivizes them to invest, locate and expand in area with lower rates.
    - **Manufacturing**.Nebraska's rapidly growing industrial rate had a negative and statistically significant impact on the state's competitive manufacturing job gains.
      1. From 2008 to 2013, the competitive disadvantage of higher industrial rates, which rose from 5.16 to 7.44 cents per kWh, cost Nebraska an estimated 3,729 manufacturing jobs.
      2. From 2008 to 2013, a 10 percent increase in Nebraska's industrial electricity rates resulted in a loss of 2.3 percent in manufacturing jobs over and above changes at the regional and national levels (Tables A3.1 and A3.2).
      3. The Nebraska food processing industry is the fourth largest electricity user among manufacturers. Furthermore, Nebraska has a significant share of the nation's employment in this industry. Thus, Nebraska's rising and high industrial electricity rates present a significant financial hurdle for one of the state's most important industries (Table 3.6).

- **Agriculture**. Over the last five years, it is estimated that rising industrial electricity rates added significantly to farming expenses.
    1. The EIA (U.S. Energy Information Association) classifies Nebraska's electricity rates for agriculture industrial, and since Nebraska has a large number of farms that utilize irrigation, the state ranks third highest in terms of industrial users.[6] Low industrial rates are vital to the profitability and sustainability of farmers and agricultural producers. Recent trends in the industrial rate, however, have been unfavorable to Nebraska's farmers.
    2. The expenditures in electricity for Nebraska's agricultural sector have increased by 107.9 percent from 2004 to 2013, with a record high of $310.2 million in 2012.[7] (Figure 4.1)
    3. Industrial electricity rates and total electricity expenditures in Nebraska's agricultural sector have gone hand in hand, increasing significantly together. From 2001 to 2013, a 10 percentincrease in industrial rates produced a 3.6 percent increase in farm expenses throughout WNC states.
    4. Over the last five years, a total of $413.3 million of added farming expense for Nebraska can be attributed to increasing industrial electricity rates. (Table A5.1, Figure 4.3)
    5. The increasing trend in industrial rates is a threat to Nebraska's farmers and agriculture producers, particularly because many farmers rely on irrigation systems that are intensive users of electricity.[8]

V. Urban versus Rural Electricity Pricing in Nebraska

- Nebraska's public utilities, with a higher proportion of industrial customers, generally charge industrial rates significantly higher than utilities that serve primarily residential customers. (Table 4.3)
- During peak times, mainly July and August, demand for electricity, particularly from irrigation systems, sometimes exceeds capacity and forces local utilities to buy excess power from sources in other states, which if purchased at elevated prices contributes to higher overall rates.
- As expected, the costs of electricity lack uniformity across the state. Rural areas, particularly in the south and west portions of the state, have higher average industrial rates than utilities that serve more urban areas.
- Currently, public utilities hold the right of first refusal for power-related development projects, especially transmission projects. This gives incumbent developers the right of first refusal when bidding on state transmission line projects. Some politicians have suggested that this right results in a less competitive bidding process.[9] This argument centers on the idea that the right of first refusal for incumbent developers discourages companies from participating in a competitive bidding process. Rather, to increase competition in the bidding process, non-incumbent private companies should be welcomed and incentivized to bid on projects in Nebraska's electricity industry.

Key Findings

VI. The President's CO_2 Reduction Program and Its Impact on Nebraska

- The Obama Administration's planned reduction in coal electricity generation will have a larger negative impact on Nebraska than on other WNC and U.S. states.
  - Nebraska's usage of coal as a fuel source for electricity generation in 2013 was more than twice that of the median for all U.S. states.
  - Coal is a relatively cheaper source of fuel for Nebraska due to the state's proximity to a large coal supply from Wyoming's Powder River Basin.
  - Except for solar, conventional coal is expected to experience the highest level of uncertainty regarding the range of expected prices from 2015 to 2020.
  - Due to Nebraska's heavy reliance on coal for electricity generation and the President's coal reduction program, input price volatility will be high, likely leading to higher volatility in electricity prices.
  - Nebraska prices, by boosting wind production 10 percent and by reducing coal production by 10 percent, would increase its overall electricity prices per kWh by 7.3 percent by 2018. (Figure 2.3)
  - In 2013, federal subsidies per kWh were 3.50 cents per kWh for wind, but a much lower 0.04 cents per kWh for coal. Without the subsidies, coal electricity production costs are significantly below that of wind.
  - Without federal electricity subsidies, Iowa's electricity rates would exceed those of Nebraska.
  - As a result of Nebraska's high coal usage and the President's coal reduction program, Nebraska's electricity price growth will likely exceed that of states that use less coal for electricity generation.

VII. Benefits and Costs of Privatization of Nebraska's Electricity Generators

- As a result of the limited market, Nebraska's two producers of electricity, OPPD and NPPD, are too small to take advantage of economies of scale that exist in power generation. Economies of scale are the cost advantages that a producer gains when more power can be generated on a larger scale and with lower input costs. These savings are typically achieved by satisfying the demands of an entire market with fixed costs spread out over more units of output.
- Between 2009 and 2014, Nebraska's electric generators' ratios of operating expenses to operating revenues were significantly above that of Mid-American Energy and the industry median.
  - The median industry operating expenses to operating revenues ratio was 82.9 percent, which was well below OPPD's 89.0 percent and NPPD's 88.1 percent.
  - Were both OPPD and NPPD able to achieve the industry average, savings would be significant. OPPD and NPPD could save an estimated $79.7 million and $85.7 million respectively for 2014. (Table 5.4)
- If privatized, Nebraska utilities would begin paying the relevant property tax rate rather than the current payments in lieu of taxes. The gain for local property taxing units would have been $61 million for 2014.
- Privatization would result in the loss of financial benefit of issuing tax exempt bonds. This loss is estimated to be $39.7 million for 2014.

Section 1: Introduction and Brief Overview of Public Power in Nebraska

Nebraska is the only state to distribute 100 percent of its electricity from public utilities. This is in contrast to most states, which usually rely on regulated investor-owned utilities for the generation, transmission, and distribution of power. In theory, public power should provide customers with lower prices compared to for-profit utilities since electricity prices do not include required profit margins. Historically that has been the case.

However, recent data show that Nebraska's electricity rates grew at a much faster pace than the rest of the nation and the WNC region. As a result, Nebraska no longer delivers electricity to consumers, both industrial and residential, at a rate below its chief competitors.

The categories of Nebraska power suppliers are:[10]

1. Municipalities
2. Agencies formed under the Nebraska Municipal-Cooperative Financing Act
3. Non-profit cooperatives
4. Rural public power districts
5. Large public power districts with generation facilities
6. Public power and irrigation districts

Table 1.1 presents a timeline of major Nebraska public power events.[11]

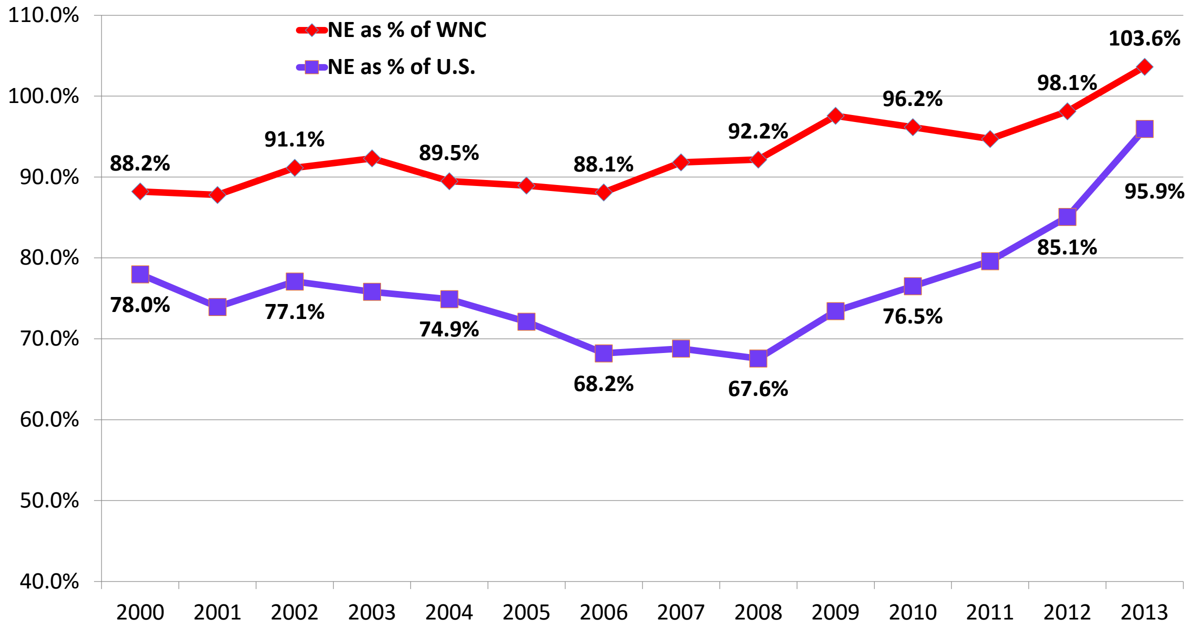
Table 1.1: Timeline of Major Nebraska Public Power Events

Date	Event
1887	Municipally owned electric systems begin operations in Crete, Nebraska.
1889	Nebraska Legislature authorizes cities to establish electric systems.
1902-1926	The number of municipal electric plants increased from 11 to 282.
1933	Nebraska legislature passed the Enabling Act that allowed and authorized the formation of public power and irrigation districts as public corporations and political subdivisions of the state.
1935	U.S. Rural Electrification Administration (REA) and Nebraska Rural Electric Association were established.
1946	The Nebraska Power Company was ordered to dissolve under the Public Utility Company Holding Act, with the formation of Omaha Public Power District.
1958	U.S. REA-financed rural electric systems are serving 95,050 farms, approximately 95 percent of total farms in the U.S.
1961	Nebraska Legislature established two committees: The Nebraska Public Power Committee composed of representatives of public power districts, and the Legislative Council Committee on Public Power, composed of state senators.
1963	Nebraska Legislature created the Nebraska Power Review Board to address problems of duplication and service area disputes.
1963	L.B. 220 granted the Board the authority to regulate construction of generation and transmission facilities in Nebraska. This authority allowed the Board to restrain suppliers from building generation capability when it was not truly needed, thus avoiding a surplus of electrical power, and unnecessarily raising the electric rates for the power supplier's customers.

Source: Nebraska Power Review Board Orientation Manual

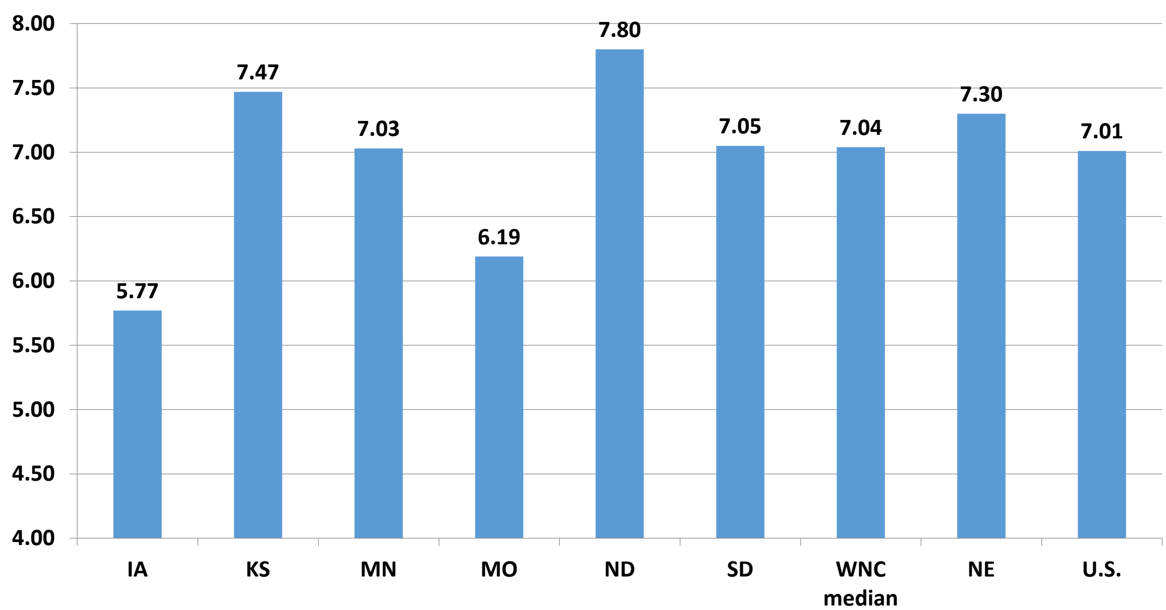
As presented in Figure 1.1, Nebraska's electricity prices have grown from 92.2 percent and 67.6 percent of the 2008 regional and national medians, respectively, to 103.6 percent and 95.9 percent of the 2013 medians. Figure 1.2 shows industrial electricity rates in cents per kilowatt-hour (kWh) for the West North Central (WNC) states and the U.S. in 2013. As indicated, Nebraska's 7.30 cents per kWh exceeded both the WNC median of 7.04 cents per kWh and the U.S. industrial rate of 7.01 cents per kWh.

Figure 1.1: Nebraska overall electricity prices per kWh as a percent of median WNC and U.S., 2000 to 2013



Source: U.S. Energy Information Association (EIA)

Figure 1.2: Industrial electricity rates cents per kWh for WNC states, Nebraska and U.S., 2014

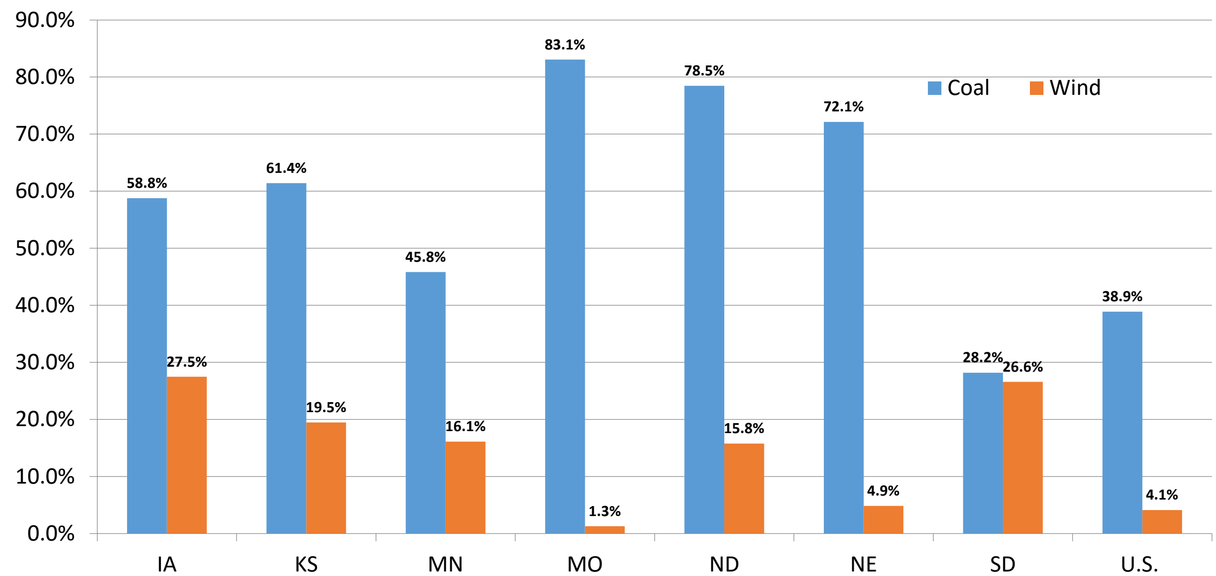


Source: EIA

Historically, Nebraska's public power producers relied on wholesale markets to export excess power to other states, generating revenue that subsidized rates charged to Nebraskans. With stricter environmental regulations restricting and reducing coal usage, and the expansion of taxpayer subsidized renewables, Nebraska's current composition of the sources of electricity generation will likely further decrease the state's electricity rate competitiveness compared to surrounding states.

Figure 1.3 compares WNC states and the U.S. in terms of the percent of electricity generated from coal and wind. As presented, Nebraska's usage of coal at 72.1 percent exceeded both the WNC median of 60.1 percent and the nation's 38.9 percent. Recently, rates have decreased in the wholesale market due to lower natural gas prices and increased capacity from wind generation. If these trends persist, the competitiveness of Nebraska's coal-reliant public power producers will continue to sink.

Figure 1.3: Percent of electricity generated from coal and wind for WNC states and U.S., 2013



Source: EIA

Based on this high-level data, the overall goal of this study is to examine the continued feasibility of providing the generation, transmission and distribution of electricity via public entities. Is the current structure optimum for overall Nebraska economic growth, and is it the methodology that produces the greatest net benefits to the Nebraska taxpayer?

Section 2: Overview of Nebraska's Electricity Market

The Net Benefits of Public Power in Nebraska

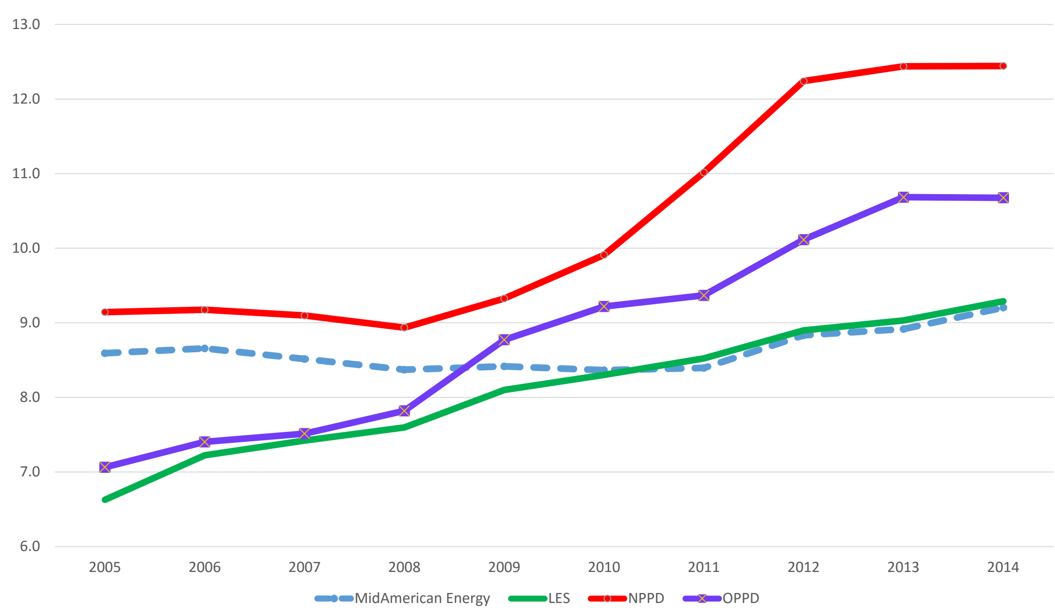
Public power companies provided electricity service to more than 2,000 communities across the nation in 2015. Supporters argue that significant benefits of public power are due to primarily local ownership and lower costs.

Public power entities are not required to operate with a profit margin and have the advantage of issuing tax-exempt bonds, which are priced at lower interest rates in the market. Tax-exempt financing reduces utilities' interest expense, a savings which may be passed along to electricity consumers. Public utilities are also exempt from paying income and property taxes which, proponents claim, also lowers rates.[12]

Figure 2.1 shows electricity rates among the three largest providers of power in Nebraska compared to MidAmerican Energy, which is a regulated investor-owned utility that primarily serves customers in Illinois, Iowa and South Dakota.[13] The assertion that Nebraska's public power delivers rates that are lower than private power, in this case MidAmerican Energy, is not supported by the data in this figure.

As presented, the electricity price gap between MidAmerican Energy and Nebraska providers widened significantly beginning in 2011. Data show that in 2014, electricity prices per kWh compared to MidAmerican Energy were; 0.9 percent higher for Lincoln Electric System (LES);[14] 35.2 percent higher for Nebraska Public Power District (NPPD); and 16 percent higher for Omaha Public Power District (OPPD).[15]

Figure 2.1: Average yearly electricity rates for MidAmerian Energy, LES, NPPD, and OPPD, 2005 to 2014



Source: EIA

Table 2.1 compares residential, commercial and industrial electricity rates among Nebraska and the six other WNC states for 2014. For industrial users, only North Dakota and Kansas have industrial electricity rates higher than Nebraska.

As listed, Nebraska ranks in the top half of the regional states in terms of overall competitiveness of its residential rates and overall electricity prices, but in the bottom half for commercial and industrial rates. While Nebraska's industrial electricity rate suggests economic development implications, it is the growth in electricity prices that pushed Nebraska into the top position in terms of electricity price growth since the national recession.

Table 2.1: 2014 electricity prices per megawatt hour (mWh) for WNC states

	Residential		Commercial		Industrial	
	Price	Ranking	Price	Ranking	Price	Ranking
Iowa	$113.51	5	$87.38	3	$57.68	1
North Dakota	$92.55	1	$85.18	1	$78.04	7
Nebraska	$104.36	2	$87.43	4	$73.02	5
South Dakota	$105.15	3	$87.37	2	$70.46	4
Missouri	$105.86	4	$88.19	5	$61.88	2
Minnesota	$121.37	7	$96.13	6	$70.34	3
Kansas	$121.27	6	$100.32	7	$74.75	6

Source: Goss & Associates calculations based on U.S. EIA data

As presented in Table 2.2, Nebraska's electricity prices expanded by 60 percent between 2007 and 2013. This was the fastest pace among WNC states and almost five times the growth of national electricity prices.

In terms of the economy, Tables 2.1 and 2.2 motivate further analysis on how Nebraska's growth rate in overall average electricity rates and the state's relatively high industrial rates have influenced economic growth.

Table 2.2: Growth in electricity prices per kWh since the recession, 2007 to 2013

Rank	State	Growth in electricity prices per kWh 2007 to 2013	% from coal 2013
1	Nebraska	60.0%	72.1%
2	Missouri	48.7%	83.1%
3	Kansas	41.1%	61.4%
4	Minnesota	34.8%	45.8%
5	South Dakota	32.2%	28.2%
6	North Dakota	32.0%	78.5%
7	Iowa	15.1%	58.8%
	U.S.	13.7%	38.9%

Source: Goss & Associates calculations based on U.S. EIA data

Differences in Electricity Prices by Nebraska Provider

The state consists of 169 different publicly-owned utilities. These include public power districts, municipal electric systems, and rural cooperatives. The largest retail distributors are OPPD, NPPD, and LES, which serve the majority of the population in the state, either directly through retailing, or as a wholesale provider of electricity to smaller, locally owned utilities throughout the state. Table 2.3 lists electricity prices per megawatt hour for the state's 13 major power districts plus what the U.S. Energy Information Administration (EIA) terms the Adjustment, which is essentially the remaining smaller 156 power districts.[16]

An analysis of the pricing data shows that across the state, compared to residential rates, industrial rates are $31.34, or 30.0 percent lower per mWh. Compared to residential rates, commercial rates are $16.93, or 16.2 percent lower per mWh.

Table 2.3: 2014 electricity prices per megawatt hour for Nebraska distributors and producers

	Residential		Commercial		Industrial		Total	
	Price	Ranking	Price	Ranking	Price	Ranking	Price	Ranking
City of Hastings	$91.29	3	$83.12	3	$61.81	2	$75.91	1
Loup River Public Power	$94.58	6	$93.46	7	$65.06	5	$76.77	2
City of Fremont	$87.00	1	$96.46	9	$70.21	6	$78.69	3
Lincoln Electric System	$92.89	4	$74.76	1	$64.75	4	$79.93	4
City of Grand Island	$89.63	2	$89.95	5	$70.26	7	$80.81	5
Norris Public Power	$93.05	5	$109.82	13	$72.20	9	$82.10	6
Omaha Public Power	$106.76	11	$85.74	4	$59.41	1	$84.22	7
Dawson Power District	$100.09	8	$92.95	6	$71.76	8	$88.21	8
Nebraska Public Power	$124.43	13	$97.02	11	$62.49	3	$90.96	9
Southern Public Power	$97.19	7	$107.45	12	$88.63	10	$91.66	10
Cornhusker Public Power	$104.46	9	$81.97	2	$90.45	11	$93.78	11
Other distributors "adjustment"	$105.49	10	$96.78	10	$97.37	12	$100.26	12
High West Energy	$125.67	14	$112.46	14	$112.83	13	$115.28	13
Midwest Electric Member Corp	$112.67	12	$96.07	8	$123.70	14	$116.18	14
Nebraska average	$104.36		$87.43		$73.02			

Source: Goss & Associates calculations based on U.S. EIA data

Furthermore, contrary to widely held beliefs, there is no statistically significant relationship between the number of customers and electricity prices. For example, three of the electricity providers with the smallest number of industrial customers, Loup River, City of Grand Island and City of Hastings, had electricity rates that were 17.2 percent below the average for all utilities. The three largest industrial electricity providers in the state in terms of the number of customers, Cornhusker, Dawson and Southern had electricity rates that were 5.4 percent above the state utility average.

Drivers of electricity costs in Nebraska

The cost to produce electricity in Nebraska depends heavily on the prices of fuel used in generation. Statewide, Nebraska relies principally on coal as the primary source of fuel. Therefore, electricity rates correlate with coal prices in the market. Coal has been a relatively cheaper source of fuel for Nebraska due to the state's proximity to a large coal supply from Wyoming's Powder River Basin.

Electricity rates also depend on the prices of other fossil fuels that Nebraska's public power entities utilize. Natural gas consumption is quite small, but the price of natural gas affects the overall wholesale market for electricity, where Nebraska's utilities sell excess power to utilities in other states. Profits generated from wholesale revenues help subsidize rates for Nebraska's consumers.

Natural gas prices have fallen substantially over recent years due to advanced extraction techniques, most commonly known as fracking. These techniques have given natural gas producers the ability to access additional reserves, increasing supply substantially. The drop in natural gas prices has significantly lowered wholesale electricity prices, reducing the profits that Nebraska utilities used in the past to help keep rates low.

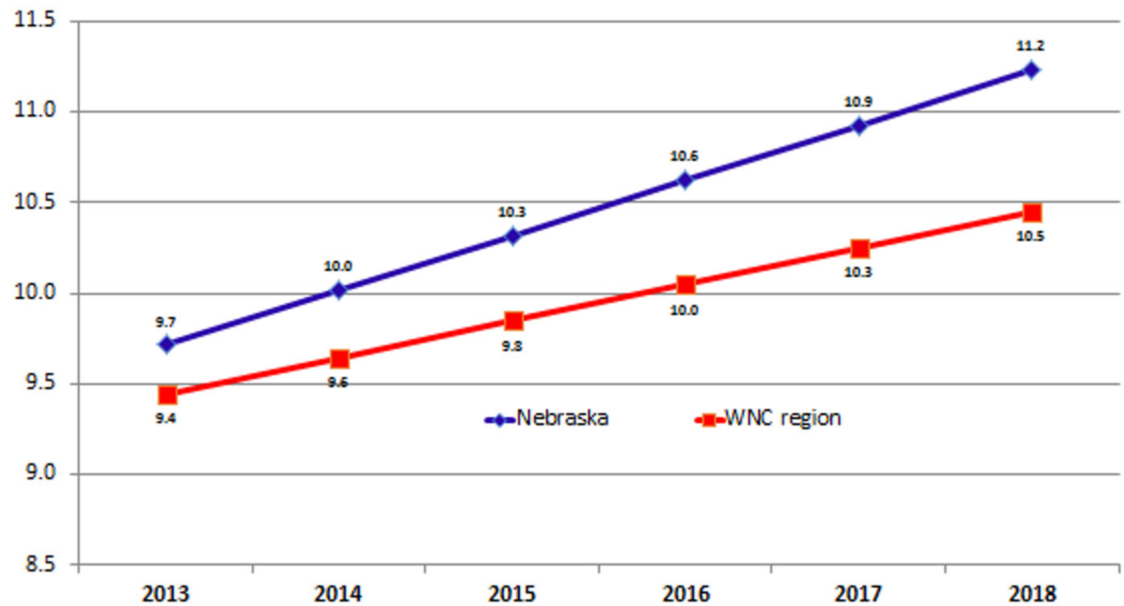
In order to establish the statistical linkage between the fuel source for electricity generation and the price of electricity, regression analysis is undertaken. The results of this statistical modeling are listed in the appendix to this section in Table A2.1. As listed, electricity prices increase as the usage of coal is displaced with increases in wind, natural gas or nuclear usage.

Thus, if as expected with the implementation of the Obama Administration's carbon emissions reduction program, coal usage is replaced with wind usage, electricity prices, other factors unchanged, would be expected to rise. Figure 2.2 provides projected Nebraska and WNC electricity prices based on the current profile of fuel input usage. As indicated, the gap between Nebraska and the region widens each year. Nebraska's electricity prices are projected to rise from 103.6 percent of the WNC median in 2013 to 106.7 percent in 2018.[17]

Using regression results from Table A2.1, projected electricity prices for the state are obtained under two scenarios. The first assumes there is no change in the distribution in fuel usage to generate electricity. The second assumes Nebraska increases wind production by 2 percent and decreases coal production by 2 percent yearly. Nebraska prices, by boosting wind production 10 percent and by reducing coal production by 10 percent, would increase its overall electricity prices by 0.18 cents per kWh, or 1.6 percent in 2018.

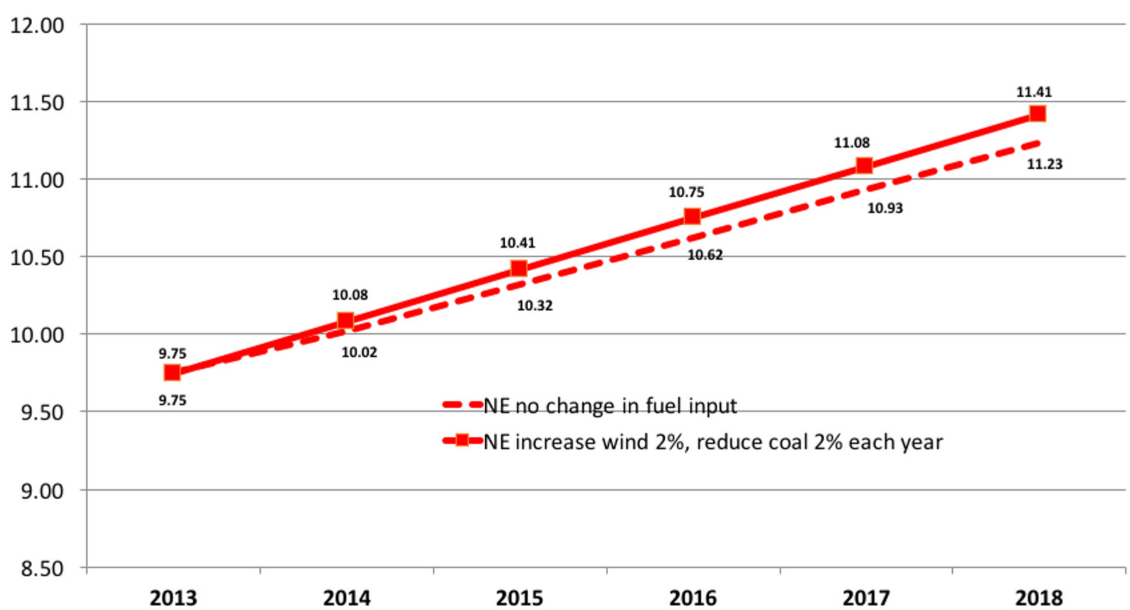
Figures 2.2 and 2.3 show these projections using statistical modeling results from Section 2 appendix.

Figure 2.2: Projected electricity prices (cents per kWh), Nebraska vs. region, 2013 to 2018 (assuming no change in fuel usage), rounded to nearest one-tenth



Source:Goss & Associates statistical model

Figure 2.3: Projected electricity prices (cents per kWh), for Nebraska, 2013 to 2018 (assuming 2% less coal and 2% more wind per year)



Source:Goss & Associates statistical model

Federal Electricity Subsidies[18]

In addition to limiting the use of coal for electricity generation, federal policies also provide subsidies that alter the optimum fuel usage for electricity generation. Federal subsidies are ubiquitous throughout the energy industry. Table 2.4 lists total federal subsidies by energy production source throughout all stages of development and distribution. Clearly, renewable sources of energy are the most subsidized source, helping accelerate the investment and development of those resources. In 2013 solar production was subsidized with a total of 46.04 cents per kWh.

As listed in Table 2.4, the federal government provided subsidies of $5.9 billion for wind energy production, $211.0 million for hydropower generation, and $703.0 million for coal creation. As listed, federal financial subsidies per kWh of wind electricity generation are approximately 88 times that of coal.

Table 2.4: Federal subsidies for wind, coal and hydropower for 2013

	Type of federal subsidy				
	Direct federal expenditure	Tax expenditures	Total 2013 subsidy	Total U.S. electricity production (kWh)	2013 sub-sidy (cents per kWh)
Wind	$4,274,000,000	$1,614,000,000	$5,888,000,000	168,000,000,000	3.50
Coal	$61,000,000	$642,000,000	$703,000,000	1,586,000,000,000	0.04
Hydropower	$194,000,000	$17,000,000	$211,000,000	269,000,000,000	0.08

Source: Goss & Associates calculations based on EIA data

Table 2.5 compares 2013 federal subsidies per kWh. As listed, renewable subsidies at 2.03 cents per kWh are significantly less than non-renewable subsidies at 0.07 cents per kWh.

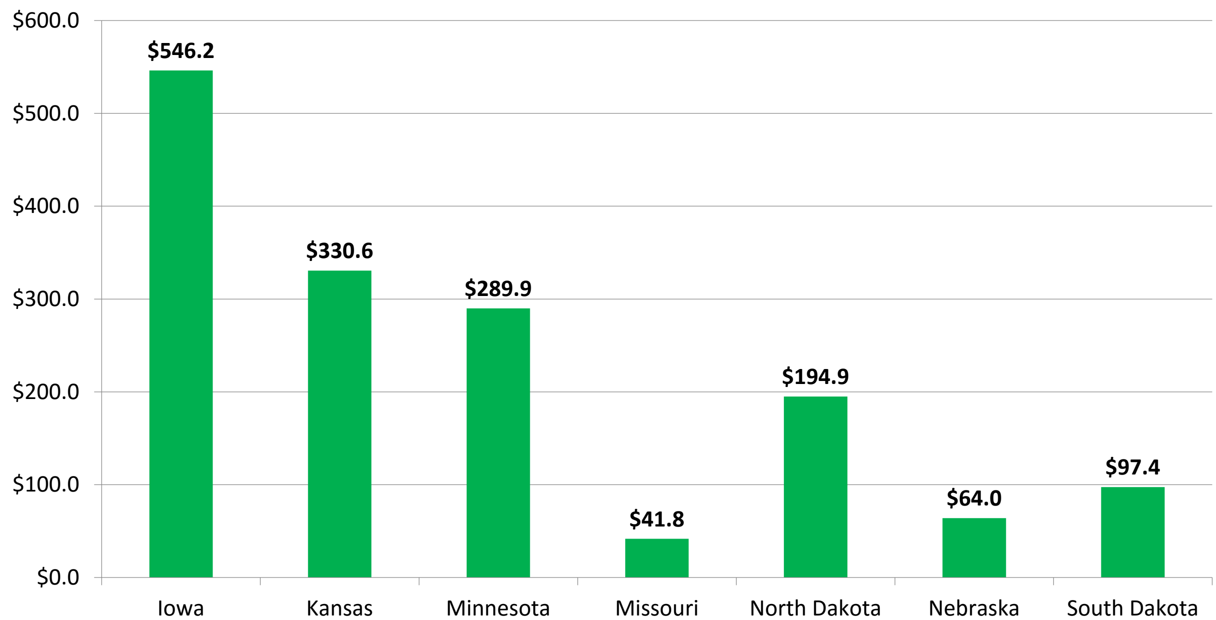
Table 2.5: Federal subsidies, 2013, cents per kWh

Beneficiary	Subsidy
Non-renewable	0.683
Renewable	
Biomass	0.35
Geothermal	1.54
Hydropower	0.08
Solar	46.04
Wind	3.51
Other	0.43
Total renewable	2.03
Total electric	0.33

Source: Goss & Associates based on U.S. EIA data

Based on these subsidies for wind and hydroelectric, estimated 2013 total electricity subsidies are estimated and presented for the WNC states for 2013. As listed in Figure 2.4, Iowa received the greatest level of federal energy subsidies at $546.2 million. Only Missouri received less than Nebraska's $64.0 million in renewable energy subsidies for 2013.

Figure 2.4: Wind and hydroelectric electric subsidies, 2013 (in millions)



Source: EIA

What is the potential impact of these federal subsidies on electricity prices among the WNC states? Table 2.6 compares the actual price of electricity among WNC states with a hypothetical price that excludes the subsidies presented in Table 2.4. The greatest beneficiaries are states that utilize wind energy production the most, which are Iowa and South Dakota.[19] As presented, Iowa reduced the price of its electricity by 11.7 percent while Nebraska cut its electricity prices by a much smaller 2.0 percent as a result of federal energy subsidies.

Table 2.6: 2013 electricity prices, per MWH with and without federal renewable subsidy

State	Actual price	Price without subsidies	% reduction in price due to subsidy
Iowa	$82.40	$92.04	11.7%
Kansas	$100.44	$107.26	6.8%
Minnesota	$96.35	$102.00	5.9%
Missouri	$90.62	$91.08	0.5%
Nebraska	$88.04	$89.77	2.0%
North Dakota	$84.93	$90.49	6.6%
South Dakota	$90.58	$100.21	10.6%

Source: Goss & Associates calculations based on U.S. EIA data

Appendix Section 2 - Statistical Analysis of Impact of Fuel on Electricity Prices[20]

Table A2.1 shows the regression output from modeling the effect of a state's fuel source composition on the price of electricity among the West North Central states. In this case, electricity prices are the dependent variable and the percent of electricity by fuel sources are the independent variables.

The results indicate that the higher the percentage of coal a state utilizes for electricity generation, the lower the cost of electricity. The higher percentage of natural gas, wind, and nuclear that a state utilizes, the higher the price of electricity.

Cross-sectional time series data were analyzed using a pooled regression model. Pooled regression combines time-series observations across several groups, usually carried out on time-series, cross sectional data as that used in the current model.

Cross sectional time series data (also known as panel data) is a dataset where the behavior of different entities, in this case states, can be observed across time. This type of dataset allows measurement of variables that differ across states and variables that change over time, but not across states.

Table A2.1: Impact of fuel choice on electricity prices WNC states, 2000 to 2013 (pooled results)

Variable	Coefficient	t-value	P-value
(Intercept)	-396.3700*	35.7940	0.0000
Percent coal	-0.7195*	-2.1732	0.0324
Percent natural gas	7.8032*	2.9280	0.0043
Percent wind	0.7995	0.7657	0.4459
Percent nuclear	0.9767	0.6468	0.1346
Population density	-0.0009	-0.3801	0.7048
Nebraska	-205.3800*	-3.4241	0.0009
NE * Year	0.1022*	3.4168	0.0010
Year	0.2011*	11.2360	0.0000
Number of observations	98		
R-squared	0.883		

"*" indicates that factor has a statistically significant impact (95% confidence)
Source: Goss & Associates analysis based on EIA data

Section 3: Economic Development and Electricity Prices

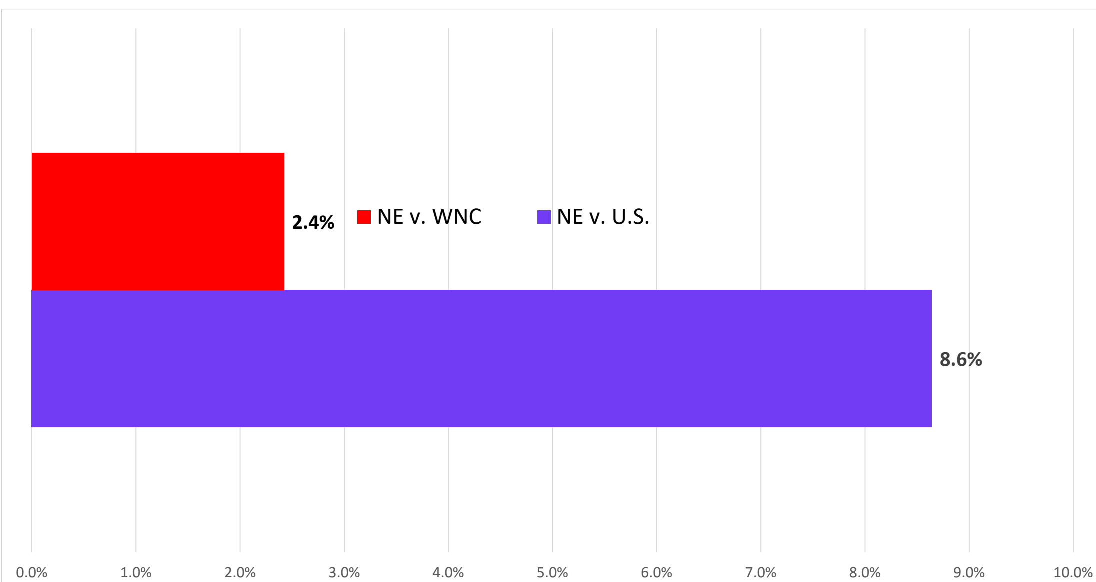
The cost of electricity is an important variable that businesses consider when deciding to locate operations in a particular state or area, especially for energy intensive industries such as data centers and manufacturing. For manufacturing firms, a state's industrial rate influences their profitability and incentivizes them to invest, locate, and expand in places with low rates.

In acknowledging the relationship between economic growth and electricity prices, state policymakers prioritized the provision of competitively priced electricity for industrial and commercial use. Furthermore, less expensive residential rates encourage individuals and families to reside in a particular locale, making employee recruitment less onerous for businesses.

Electricity customers in Nebraska are categorized by Nebraska public power companies as residential, commercial, or industrial users, based on the level of electricity use. As a general rule, OPPD classifies all non-residential users as commercial or industrial customers. Commercial users demand less than 1,000 kWh per month and industrial customers require more than 1,000 kWh per month.[21] Given that residential customers are typically less sensitive to electricity prices than are commercial and industrial users, it is expected, and found, that residential rates are higher.

Figure 3.1 compares Nebraska's industrial electricity rates with the national average and the regional median. As illustrated, the state's industrial rates are 8.6 percent higher than the U.S. average and 2.4 percent above the regional median. This higher industrial rate is a consideration for economic development because it makes Nebraska a less attractive state for industrial growth and may be contrary to optimum electricity pricing strategies.[22]

Figure 3.1: Nebraska price differences from U.S. averages, June 2015



Source: EIA

A 2011 study of Kentucky's electricity prices found that the residential sector is sensitive to price changes, but only in the short run. The study also found that the industrial and commercial sectors were the quickest to alter their electricity consumption, which could negatively affect economic growth and employment.[23]

Nebraska's industrial rate pricing category also includes farmers who are served in rural areas and make up a greater portion of industrial usage compared to states with economies less concentrated in agriculture. It is argued that Nebraska's comparably higher industrial rates reflect higher costs of service, particularly from higher transmission and distribution costs in rural areas. Farmland is generally distant from electricity generating facilities requiring expansive infrastructure, driving up the cost of delivering electricity per user. Industries that are closer to power plants and/or located in more concentrated areas and are less expensive to serve when including the costs of transmission and distribution infrastructure.

Industrial rates in Nebraska have grown from significantly below the U.S. average to above average between 2011 and 2014. Table 3.1 shows industrial rates from 2005 to 2014. From 2005 to 2011, national industrial rates were as much as 35.1 percent above Nebraska's prices in 2006, to as low as 6.1 percent above the Nebraska rate in 2011. In 2012, Nebraska's electricity rates moved above U.S. rates and remained so for subsequent years. Although customers in rural areas are generally more expensive to serve, that doesn't explain significant increases in rates in recent years.

Table 3.1: Industrial electricity rates for WNC states, 2005 to 2014 ($$s per MWH)

State	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Iowa	$4.56	$4.92	$4.74	$4.81	$5.27	$5.36	$5.21	$5.30	$5.62	$5.77
Kansas	4.85	5.20	5.13	5.69	6.10	6.23	6.71	7.09	7.39	7.47
Minnesota	5.02	5.29	5.69	5.87	6.26	6.29	6.47	6.54	6.98	7.03
Missouri	4.54	4.58	4.76	4.92	5.42	5.50	5.85	5.89	6.29	6.19
North Dakota	4.32	5.00	5.24	5.59	5.25	5.81	6.24	6.55	7.13	7.80
South Dakota	4.95	4.84	5.09	5.31	5.65	6.07	6.20	6.57	6.97	7.05
WNC median	$4.71	$4.96	$5.11	$5.45	$5.54	$5.94	$6.22	$6.55	$6.98	$7.04
Nebraska	$4.43	$4.56	$4.78	$5.16	$5.75	$6.00	$6.43	$7.01	$7.44	$7.30
USA	$5.73	$6.16	$6.39	$6.96	$6.83	$6.77	$6.82	$6.67	$6.84	$7.01

Source: EIA

Table 3.2 lists compound annual growth and volatility of industrial electricity rates for Nebraska, WNC states and the U.S. from 2005 to 2014.[24] Except for North Dakota, Nebraska had the highest annual growth of 5.7 percent compared to regional and national medians of 4.6 percent, and 2.3 percent, respectively. Additionally, Nebraska had the greatest industrial electricity price volatility among all comparison states, the WNC median, and the rest of the nation.

Table 3.2: Compound annual growth rates and volatility in industrial electricity rates

	2005 to 2011		2011 to 2014		2005 to 2014	
	Compound annual growth	Volatility	Compound annual growth	Volatility	Compound annual growth	Volatility
Iowa	2.2%	0.30	3.5%	0.26	2.6%	0.39
Kansas	5.6%	0.68	3.6%	0.34	4.9%	0.96
Minnesota	4.3%	0.54	2.8%	0.29	3.8%	0.67
Missouri	4.3%	0.51	1.9%	0.22	3.5%	0.66
North Dakota	6.3%	0.61	7.7%	0.69	6.8%	1.05
South Dakota	3.8%	0.54	4.4%	0.39	4.0%	0.82
WNC median	4.7%	0.54	4.2%	0.39	4.6%	0.83
Nebraska	6.4%	0.77	4.3%	0.45	5.7%	1.14
USA	2.9%	0.45	0.9%	0.14	2.3%	0.41

Source: Goss & Associates based on EIA data

Impact of Nebraska's Higher Industrial Rates on Economic Growth

To determine the effect of higher industrial rates on economic growth, the data were analyzed using a shift-share methodology. Shift-Share Analysis is a technique used to disaggregate the sources of historical growth of regions, states and nations for a specific period of time. This methodology helps identify the growth for each year due to the region's competitive advantage versus other sources of growth.

More precisely, shift-share analysis allows disaggregation of growth that was produced by (1) an expanding national economy, (2) a favorable mix of industries, and (3) by competitive factors such as electricity prices.[25] As a result, policymakers can explore the advantages and disadvantages enjoyed by their local areas, as well as identify growth or potential growth industries that may benefit from further expansion.

Shift-share analysis decomposes a state's employment growth or decline over a given time period into three components: (1) a national growth effect (NGij), which is the change in employment in a state ascribed to the rate of national employment growth for all industries; (2) an industry mix effect (LMij), which is the amount of change the state or region would have experienced had each of its industries grown at their national rates; and (3) a competitive effect (CEij), which is the difference between the actual change in employment and the employment change to be expected if the industrial sector grew at the national rate. This last component, CEij, is due to state economic development factors, including electricity rates. The sum of these three effects equals the actual change in total employment within an area or state over a prescribed time period.

Figure 3.2 shows Equations (3.1), (3.2) and (3.3) used to calculate each element of Nebraska's shift-share employment changes for manufacturing.[26]

Figure 3.2: Calculation of competitive effect for Manufacturing in Nebraska

(3.1) National growth effect (NGij) for Nebraska manufacturing = $(E_{manufacturing,\ Nebraska}) * R_n$
where $E_{manufacturing,\ Nebraska}$ = the number of manufacturing employees in Nebraska in 2000 and
R_n = growth rate across all industrial sectors in the United States between 1998 and 2013.[27]

(3.2) Industry mix effect LMij $(IM_{manufacturing,\ Nebraska}) = E_{manufacturing,\ Nebraska} * (R_{manufacturing} - R_n)$ where $R_{manufacturing}$ is the growth rate in U.S. manufacturing between 1998 and 2013.

(3.3) Competitive effect CEij $(CE_{manufacturing,\ Nebraska}) = E_{manufacturing,\ Nebraska} * (R_{manufacturing,\ Nebraska}) - R_{manufacturing,})$ where $R_{manufacturing,\ Nebraska}$ is the growth rate in Nebraska manufacturing between 1998 and 2013.

Table 3.3 divides the change in manufacturing employment among the WNC states, including Nebraska, from 1998 to 2013 using shift-share analysis. Table 3.4 shows the component change in manufacturing employment for the period 2008 to 2013. For this latter period, Missouri and North Dakota were the only states to experience a negative competitive effect.

Table 3.3: Shift-share analysis of WNC manufacturing, employment change and (percent change), 1998 to 2013

State	National growth	Industry mix	Competitive effect	Total change 1998-2013 (percent change)
Nebraska	10,292	-46,975	35,306	-1,377 (-1.3%)
Iowa	23,024	-105,085	44,970	-37,092 (-15.1%)
Kansas	18,446	-84,194	29,542	-36,205 (-18.4%)
Minnesota	35,518	-162,113	47,770	-78,825 (-20.3%)
Missouri	35,857	-163,660	-9,446	-137,249 (-35.9%)
North Dakota	2,179	-9,943	7,997	232 (+1.0%)
South Dakota	4,513	-20,600	11,706	-4,380 (-9.1%)

Source: Goss & Associates estimates based on County Business Pattern data

Table 3.4: Shift-share analysis of WNC manufacturing, employment change and (percent change), 2008 to 2013

State	National growth	Industry mix	Competitive effect	Total change 2008-2013 (percent change)
Nebraska	-2,290	-12,299	17,860	3,271 (3.1%)
Iowa	-4,978	-26,730	11,707	-20,000 (-8.8%)
Kansas	-4,001	-21,484	2,388	-23,097 (-12.6%)
Minnesota	-7,275	-39,065	12,406	-33,934 (-10.2%)
Missouri	-6,351	-34,105	-5,946	-46,402 (-15.9%)
North Dakota	-605	-3,251	-457	-4,314 (-15.5%)
South Dakota	-944	-5,069	6,439	426 (1.0%)

Source: Goss & Associates estimates based on County Business Pattern data

The next step is to estimate the impact of industrial electricity prices on the competitive effect for manufacturing for the states. In order to control for factors beyond the region, the analysis is limited to the WNC states. Furthermore, in order to eliminate the size effects, the competitive effect is divided by the size of the manufacturing sector in terms of jobs. It is also assumed that industrial rates in year "t" (e.g. 2012) influence the competitive effect in year "t+1" (e.g. 2013). In this case, the data are divided into the periods before and after the national recession.[28]

Those modeling results are contained in Tables A3.1 for Nebraska compared to the U.S., and A3.2 for Nebraska compared to the WNC states. These results show several important outcomes:

1. The industrial electricity rate had no statistically significant impact on competitive manufacturing job gains from 2002 to 2007 for Nebraska, the WNC, and the U.S.
2. Nebraska's competitive manufacturing job gains were statistically larger than other WNC states and the U.S. from 2008 to 2013, resulting from factors other than electricity prices.
3. Higher industrial electricity rates had a negative and statistically significant impact on Nebraska's competitive manufacturing job gains from 2008 to 2013. This impact is over and above that for other WNC states, and the U.S.
4. Industrial electric rates in Nebraska grew the most in the latter years, from 2008 to 2013. Over this time period, the competitive disadvantage of higher industrial rates, which rose from 5.16 to 7.44 cents per kWh, cost Nebraska an estimated 3,729 manufacturing jobs, while Nebraska competitive factors other than electricity rates produced job gains, of 21,589 for the state's manufacturing sector

Electricity Usage and the Concentration of Manufacturing

Table 3.5 contains the top 17 electricity users among U.S manufacturers for 2013, along with their electricity usage for 2010 and Nebraska's location quotients for 2013.[29] A location quotient greater than 1.0 indicates that Nebraska has more than its expected share of national employment in the particular industry. A location quotient less than 1.0 indicates that Nebraska has less than its expected share of national employment.

As indicated in Table 3.5, the industries where Nebraska has a higher concentration of jobs than the U.S. are in general not the largest users of electricity. In fact, the correlation coefficients between electricity usage and location quotients are negative indicating that high electricity usage industries tend to have low concentration ratios, or location quotients, in Nebraska. Furthermore, Nebraska's recent increases could present a problem for the state as these heavy users may expand or event relocate to other states.

Table 3.5: Largest electricity users among manufacturing industries for 2010 and Nebraska location quotients for 2013

Rank	NAICS Code	Manufacturing Industry	Millions of kWh usage Per Billion GDP (2010)	Location quotient 2013
1	331	Primary Metals	2,541	0.96
2	322	Paper	1,872	0.55
3	327	Nonmetallic Mineral Products	907	0.61
4	313	Textile Mills	855	3.32
5	321	Wood Products	756	0.01
6	326	Plastics and Rubber Products	728	1.15
7	325	Chemicals	565	0.71
8	324	Petroleum and Coal Products	508	0.78
9	323	Printing and Related Support	353	1.04
10	311	Food	353	0.68
11	332	Fabricated Metal Products	310	1.41
12	335	Electrical Equip., Appliances, and Components	214	0.57
13	336	Transportation Equipment	192	0.84
14	333	Machinery	168	0.24
15	334	Computer and Electronic Products	119	0.62
16	339	Miscellaneous manufacturing	95	0.34
17	312	Beverage and Tobacco Products	38	1.21

Source: Goss & Associates calculations based on EIA and U.S. Census data

Summary

For economic development, this section has shown that industrial rates have risen to uncompetitive levels for Nebraska since 2012, compared to the U.S. and the WNC states region. Higher industrial rates have produced a negative effect on the number of manufacturing jobs in the state, since firms are less likely to relocate and invest in operationally more expensive locations. Nebraska's energy-intensive industries, such as food processing, are susceptible to increased operational expenses due to higher rates.

Appendix Section 3 - Regression analysis of competitive shift-share

The regression output from estimating the industrial rate's effect on the ratio of competitive effect per manufacturing job for the United States is displayed in Table A3.1 below. From 2002 to 2007, the results indicate that a lower industrial rate leads to increased competitive effect. An increase in the competitive effect suggests that jobs created in a state are being influenced by regional factors, specifically the competitive advantage of states with lower rates. From 2008 to 2013, the data supports that a similar relationship exists for the state of Nebraska, but is inconclusive for all states.

Table A3.2 shows regression output for the same model using data from WNC states instead of the entire United States. Although not statistically significant, the regression output suggests that lower industrial rates lead to higher competitive effects within WNC states for the 2002 to 2007 time period. From 2008 to 2013, the same relationship exists and is statistically significant for the state of Nebraska.

For the results in Table A3.1 and Table A3.2, cross-sectional time series data were analyzed using a pooled regression model. Pooled regression combines time-series observations across several groups, usually carried out on time-series cross sectional data as used in the current model. Cross sectional time series data (also known as panel data) is a dataset where the behavior of different entities, in this case states, can be observed across time. This type of dataset allows measuring of variables that differ across states and variables that change over time, but not across states.

Table A3.1: Coefficients for industrial rate's effect on the ratio of competitive effect per manufacturing job (U.S.)			
First half (2002 to 2007)			
	Estimate	t-value	p-value
Intercept*	0.014	2.267	0.024
Industrial rate per MWH	-0.139	-1.437	0.152
Nebraska other factors	0.237	1.347	0.179
Nebraska's industrial rate	-0.055	-1.301	0.194
Number of observations	250		
Second half (2008 to 2013)			
	Estimate	t-value	p-value
Intercept	0.002	0.410	0.682
Industrial rate (last year's)	-0.001	-0.356	0.722
Nebraska other factors	0.322*	3.368	0.001
Nebraska's industrial rate	-0.048*	-2.976	0.003
Number of observations	250		

*Factor has a statistically significant impact (95% confidence)
Source: Goss & Associates based on EIA and U.S. Census data

Table A3.2: Estimation of industrial rate's effect on the ratio of competitive effect per manufacturing job (WNC)			
First half (2002 to 2007)			
	Estimate	t-value	p-value
Intercept	0.052	0.637	0.528
Industrial rate (last year's)	-0.007	-0.415	0.681
Nebraska other factors	0.200	0.855	0.398
Nebraska's industrial rate	-0.048	-0.876	0.386
Number of observations	35		
Second half (2008 to 2013)			
	Estimate	t-value	p-value
Intercept	0.083	1.653	0.107
Industrial rate (last year's)	-0.012	-1.427	0.167
Nebraska other factors	0.242*	2.322	0.0257
Nebraska's industrial rate	-0.036*	-2.040	0.048
Number of observations	35		
*Factor has a statistically significant impact (95% confidence) Source: Goss & Associates based on EIA and U.S. Census data			

Section 4: Power in Rural Nebraska and the Agriculture Sector

Electricity Rates for Agriculture

The EIA classifies Nebraska's agriculture sector as an industrial electricity buyer. Since Nebraska has a large number of farms that utilize irrigation fueled by electricity, the state ranks third highest in the nation in terms of industrial users.[30]

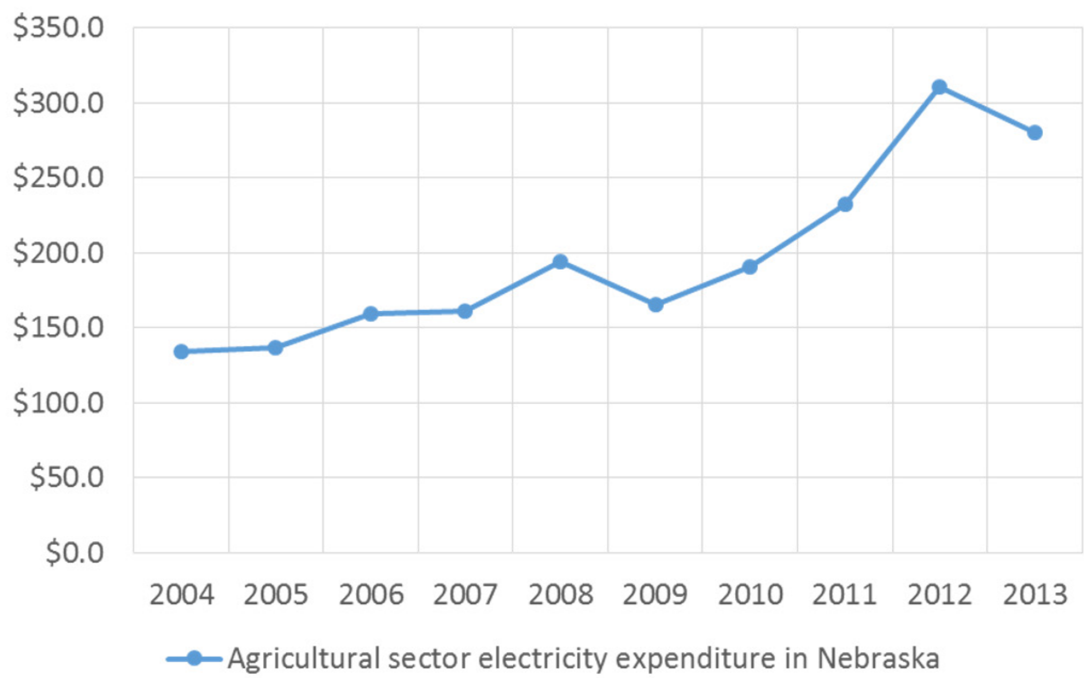
Affordable industrial rates are vital to the profitability and sustainability of Nebraska's farmers and agricultural producers. Recent trends in the industrial rate indicate that the state's large agriculture sector has been differentially and negatively affected by the state's upward trend in industrial electricity rates.

Effect of Electricity Rates on Farm Production Expenses

The increasing trend in industrial rates particularly impacts Nebraska's farmers and agriculture producers because many rely on energy-intensive irrigation systems.[31] Not surprisingly, the expenditures in electricity for Nebraska's agricultural sector have doubled over the last ten years.

The rise in industrial electricity rates, along with growing electricity use in Nebraska's agricultural sector, has resulted in a substantial increase in electricity expenditures, with a record high of $310.2 million in 2012.[32] Figure 4.1 profiles agriculture electricity expenditures from 2004 to 2013 and indicates a 107.9 percent increase in electricity expenditures by the agriculture sector during that period of time.

Figure 4.1: Nebraska's agricultural sector spending on electricity, 2004 to 2013 (millions of $$s)



Source: U.S. Department of Agriculture, Nebraska Energy Office

Table 4.1 highlights the percentage change of Nebraska's industrial rate compared to WNC states over both a ten-year and a five-year time period. Nebraska's rates grew at the second highest rate in both time periods, with only North Dakota's rates growing faster.

Data in Table 4.1 also show the relative dependency on farming of each WNC state and the U.S. for 2013. As indicated, Nebraska is second only to South Dakota in terms of farm dependency. Thus, the high electricity usage in agriculture and the high concentration of agriculture in Nebraska presents an economic development challenge in the state, especially if industrial rates continue on their current growth trajectory.

Table 4.1: Percent change of industrial electricity rates over a 10-year and 5-year period

	Industrial electricity rates		
State	Farm GDP as a share of total GDP (2013)	10-year % change	5-year (2009 to 2014) % change
Iowa	8.2%	26.4%	7.6%
Kansas	5.7%	54.0%	19.9%
Minnesota	2.4%	40.1%	11.9%
Missouri	1.9%	36.2%	12.4%
Nebraska	10.0%	64.8%	21.6%
North Dakota	5.4%	80.5%	34.3%
South Dakota	11.0%	42.3%	16.2%
USA	1.2%	22.3%	3.6%

Source: Goss & Associates calculations based on EIA and U.S. BEA data.

Additionally, the relationships between industrial rates and farm expenses were calculated and presented in Table A4.2 of the appendix. Increases in industrial electric rates have led to higher farm expenses in Nebraska and throughout WNC states. From 2001 to 2013, it is estimated that a 10 percent increase in industrial rates had the effect of a 3.6 percent increase on farm expenses throughout WNC states. In Nebraska, a 10 percent increase had the effect of a 2.3 percent increase in farm expenses.

Over the last five years, it is estimated that a total of $362.8 million of added expense to the state's farming industry can be attributed to increasing industrial electricity rates (see Table A4.1 in the appendix). Table 4.2 shows the contribution of rising industrial electricity rates to farm expenses from 2010 to 2014.

Over this same five-year time period, Nebraska's industrial rate eclipsed the average industrial rate in the United States. Normally well below U.S. averages, over the last five years, Nebraska's industrial rate has consistently trended above averages in the U.S.

Table 4.2: The effect of electric rates on Nebraska's farm production expenses (2015 dollars in thousands)

	2010	2011	2012	2013	2014
Farm production expenses	$6,019,339	$6,114,237	$7,661,536	$7,708,077	$7,523,522
Yearly farm expense growth	-2.95%	1.58%	25.31%	0.61%	-2.39%
Industrial electric rate (cents per kWh)	6.00	6.43	7.01	7.44	7.30
Yearly electric rate growth	4.35%	7.17%	9.02%	6.13%	-1.88%
Farm expense growth attributable to electric rate change (percentage)	1.00%	1.65%	2.07%	1.41%	-0.43%
Value of farm expense growth attributable to electric rate change	$62,021	$99,219	$126,849	$108,092	-$33,360

Source: Goss & Associates

Regional Differences in Nebraska

Nebraska's industrial electricity demand is affected by the needs of irrigation in the state, which tends to lead to higher industrial rates due to higher expenses from costs related electricity delivery infrastructure in rural, less-densely populated areas. Farmers make up a significant portion of Nebraska's total industrial rate consumers, which totaled an average of 56,359 in 2013. According to the USDA, Nebraska has 15,474 farms with 21,609,279 acres of total farmland, of which 8,297,560 acres are irrigated (38.4 percent). The concern is that Nebraska's large agricultural sector, with high irrigation needs, skews the reported average industrial rate, making the data less comparable to other states.

Over the last five years, the average industrial electricity rate in Nebraska, as reported by the Energy Information Administration (EIA), has increased by 21.6 percent, from 6.2 cents per kWh in 2010 to 7.5 cents per kWh in 2014. It could be argued that some of this reported rate increase is due to substantial demand from irrigators during summer months when peak pricing is more prominent, which would lead to higher average industrial rates.

Two neighboring states, Colorado and Kansas, have substantial irrigation needs as well, albeit much smaller than Nebraska. Colorado has 12,397 farms with a total of 11,929,608 acres of farmland, with 2,309,543 acres irrigated (19.4 percent). Kansas has 5,147 farms with a total of 13,099,354 acres of farmland, with 2,851,317 acres irrigated (21.8 percent).

Comparing these three neighboring states, the magnitude of irrigation does not specifically lead to a conclusion about irrigation's effect on reported industrial rates and industrial rate growth over the last five years of data. Among Nebraska, Colorado, and Kansas, the average 2014 industrial rates were quite similar: Nebraska at 7.3 cents per kWh, Colorado at 7.3 cents per kWh, and Kansas at 7.5 cents per kWh. As discussed earlier, industrial rate growth was highest in Nebraska from 2010 to 2014, but only slightly higher compared to Kansas. Colorado, which has similar irrigation level to Kansas, only grew rates by 5.5 percent.

If one were to presume that irrigators skew the EIA's reported average industrial rate, due to usage during peak season, then it can be assumed that Nebraska's industrial rate for non-farmers is less than the reported average. But this would also be the case for Colorado and Kansas, just to a lesser extent than Nebraska. This presumed larger effect could be due to the fact that Nebraska's agricultural sector is larger than Colorado's and Kansas's agricultural sectors. The percentage of farmland irrigated is larger in Nebraska than in Colorado and Kansas as well. Nebraska's larger agricultural sector does suggest that irrigation needs have the propensity to skew reported average industrial rates due to peak season demand, but it does not explain the higher industrial electricity price rate growth compared to Colorado and Kansas over the last five years.[33]

During peak times, mainly July and August, demand for electricity, particularly from irrigation systems, sometimes exceeds capacity and forces local utilities to buy excess power from sources in other states, which if purchased at elevated prices contribute to higher overall rate increases. This leads to higher average electricity rates over the year and higher expenditures for farmers. Local public utilities must also invest in building and maintaining a high amount of transmission and distribution lines per customer served.

Table 4.3 demonstrates that Nebraska public utilities, with a higher proportion of industrial customers, generally charge industrial rates significantly higher than utilities serving urban areas. Additionally, the costs of electricity are not uniform across the state for utilities serving different regions. Higher rates are consistent with utilities serving rural areas, where most industrial users are farmers using irrigation systems. For example, in 2014 Midwest Electric Cooperative Corporation, serving the Western portion of the state, operating in the counties of Perkins, Lincoln, Chase, and Keith, charged an average industrial rate of 12.37 cents per kWh, which is significantly higher than the state's industrial average of 7.30 cents per kWh.

Table 4.3 also shows average electricity rates among several utilities in Nebraska. Rural areas, particularly in the south and west portions of the state, charge higher average industrial rates than utilities serving more urban areas. High West Energy, Inc. and Midwest Electric Cooperative, serving rural counties on the Western border, charged the highest average industrial rate in 2014 of 11.28 and 12.37 cents per kWh, respectively.

The data reinforce the conclusion that Nebraska's agricultural sector is an important factor pushing the state's industrial rates higher.

Table 4.3: Number of industrial customers and electricity rates for Nebraska utilities, 2014

Utility	Industrial rate (cents per kWh)	# of industrial customers	% of customers that are industrial
High West Energy, Inc.	11.28	1,196	39.62%
Southern Public Power District	8.86	9,382	35.17%
Midwest Electric Member Corp	12.37	2,057	32.17%
Dawson Power District	7.18	5,759	25.17%
Cornhusker Public Power District	9.04	2,277	23.41%
Norris Public Power District	7.22	1,826	9.84%
City of Fremont	7.02	497	3.31%
Nebraska Public Power District	6.25	735	0.82%
City of Hastings	6.18	98	0.74%
City of Grand Island	7.03	98	0.39%
Loup River Public Power District	6.51	54	0.28%
Lincoln Electric System	6.47	186	0.14%
Omaha Public Power District	5.94	177	0.05%
Other utilities	9.74	28,999	10.00%
All	7.3	53,341	5.17%

Source:

Appendix Section 4 - Regression analysis of impacts of industrial rates on agriculture expenses

Table A4.1 shows the regression output from a model that estimates the industrial rate's effect on production expenses in the agriculture sector in Nebraska. The results suggest that as industrial rates increase, production expenses increase as well, at a magnitude of 0.23% for every 1% increase in industrial rates. The results are significant at the 10% level for U.S. industrial rates.

For the regression in Table A4.1, cross-sectional time series (also known as panel data) data were used. This type of data requires the use of pooling regression techniques the model combines time-series observations across several groups. Cross sectional time series data is a dataset where the behavior of different entities, in this case states, can be observed across time. This type of dataset allows us to measure variables that differ across states and variables that change over time but not across states.

Table A4.1: Coefficients for industrial rate's effect on production expenses in the agriculture sector in WNC region

All years (2001 to 2013)			
	Estimate	t-value	p-value
Industrial rates	0.361	1.844	0.069
Nebraska's industrial rate	-0.134	0.132	0.316
Year	0.045	5.51	4.14E-07
Goodness of fit (R-squared)	0.886		
Number of observations	91		

Source: Goss & Associates based on EIA and U.S. Census data

Section 5: Alternative Approach for Electric Power in Nebraska

Given that Nebraska's electricity rates have recently grown at rates significantly above that of its neighbors and the U.S. average, there is increasing motivation for investigating the impact of alternative methodologies of delivering electricity to residential, commercial and industrial users.

Several factors emerge in evaluating which approach is optimal between private, public, or a hybrid power model. The most important of these issues are risks, costs, and economic competitiveness. Which approach places the least risk on taxpayers, individuals, businesses, and non-profit organizations in the state, and which increases the economic competitiveness of Nebraska?

The Costs and Benefits of Private Power Generation in Nebraska

The primary factors currently supporting privatization are:

1. **Risks**. The risks associated with the Obama Administration's carbon emissions program and with nuclear energy power interruptions incentivize shifting this risk away from Nebraska taxpayers and to shareholders of a private electricity generators.
2. **Economies of scale**. In order to achieve lower average costs, an electricity provider in the state should be much larger than OPPD and NPPD, or a combination of the two.
3. **Higher property taxes for local governments**. Currently, OPPD and NPPD make payments in lieu of property taxes that are significantly less than property taxes.

The primary factors supporting public electricity generation are:

1. **Tax exempt bonds**. Public power companies in Nebraska can issue tax exempt bonds while private power providers have no such authority.
2. **Public accountability**. Public power companies are accountable to the voters in the state rather than to stockholders.
3. **Profits**. Profits or margins remain in the state.

Risks

What are the chief risks to Nebraska's electricity users in terms of electric power and do they differ for private and public options? A very significant risk is variation or deviation in rates. If there is sufficient deviation in electric power costs, then it may make sense to transfer this risk to an investor-owned utility, potentially shielding Nebraska's taxpayers and electricity users from this deviation.

Table 5.1 contains electricity price volatility data for the period 2005 to 2013. Expressed as standard deviation,[34] data show that Nebraska's volatility in overall electricity prices was the highest in the region and 45.4 percent above the regional average. Calculations also indicate that industrial electricity rates for Nebraska were much more volatile than that for any other state in the region.

Table 5.1: Volatility in electricity prices (cents per kWh), 2005 to 2013

	Residential	Industrial	All users
Iowa	0.75	0.35	0.48
Kansas	1.55	0.90	1.15
Minnesota	1.34	0.63	0.91
Missouri	1.45	0.63	1.12
North Dakota	0.93	0.86	0.77
South Dakota	1.06	0.76	0.80
WNC median (X-Nebraska)	1.20	0.70	0.86
Nebraska	1.61	1.08	1.25

Source: Goss & Associates calculations based on EIA data

In terms of future volatility, Nebraska, due to its heavy reliance on coal for electricity generation, will likely experience high input price volatility leading to higher volatility in electricity prices. Table 5.2 lists the estimated levelized cost of electricity per MWH for new generation in 2020. As presented, except for solar, conventional coal is expected to experience the highest level of uncertainty regarding the range of expected prices as a percent of the mid-point of the levelized cost of new generation in 2020.

Table 5.2: Estimated levelized cost of electricity per MWH for new generation resources in 2020					
	Minimum	Expected price	Maximum	Range	Range as % of expected price
Conventional coal	$87.10	$95.10	$119.00	$31.90	33.5%
Advanced coal	$106.10	$115.70	$136.10	$30.00	25.9%
Natural gas fired (conventional combined cycle)	$70.40	$75.20	$85.50	$15.10	20.1%
Wind	$65.60	$73.60	$81.60	$16.00	21.7%
Solar thermal (not including subsidy of $19.2)	$174.40	$239.70	$382.50	$208.10	86.8%
Sources: EIA "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2015," page 7.					

Increasing federal regulations is the major driver of this price uncertainty. In August 2015, President Obama and the EPA announced the Clean Power Plan to control greenhouse gas emissions from coal-fired power plants. A White House spokesman said the plan will require a nationwide 32 percent reduction in carbon dioxide emissions from 2005 levels by 2030.

The Administration set Nebraska's target reduction at 40 percent, which is significantly higher than the 26 percent proposed in earlier versions of the rule.[35] Unless litigation blocks the plan's implementation, or a new Administration rescinds the rule, the Clean Power Plan will be especially costly for Nebraska as 72.1 percent of its electricity was generated by coal in 2013.[36]

Other risks include regulatory actions, such as shutdowns by regulatory agencies that inspect or monitor various forms of electricity generation. For example, as a result of the 2011 floods, and a fire at the Fort Calhoun Nuclear Generating Station in Blair, the Nuclear Regulatory Commission (NRC) shut down the facility for almost three years.

During the 32-month shutdown, Exelon Nuclear Partners managed the plant while OPPD maintained ownership. Ultimately, the recommissioning of Fort Calhoun cost the Nebraska ratepayer an estimated $177 million.[37] This represents approximately 18 percent of OPPD's yearly operating expenses.[38]

Nebraska's electricity rates rose from 94 percent of the U.S. average in 2011 to 109 percent of the U.S. average in 2013. These data support the hypothesis that the Fort Calhoun shutdown and recovery costs were a significant driver of Nebraska's rapid growth in electricity prices beyond 2011.

NPPD also owns Cooper Nuclear Station in Brownville, Nebraska. On November 3, 2010, the NRC reported safety issues with the facility. While there was no shutdown, the NRC concluded that "human factors (sic) deficiencies were inadvertently designed into the equipment."[39]

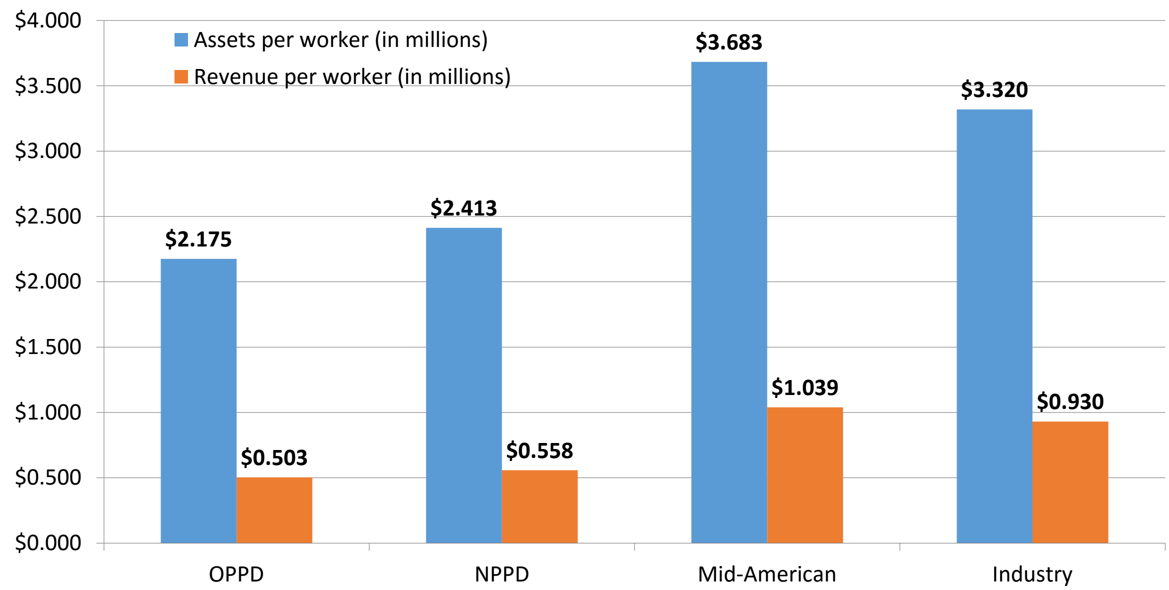
In 2011, a problem with the facility's emergency equipment added to the cost of a refueling shutdown. This problem came just weeks after three workers were exposed to radiation at the facility.[40] In 2013, NRC regulators indicated that NPPD needed to improve how workers respond to problems at the power plant.[41]

Diseconomies of scale

As a result of the limited state market, Nebraska's two producers of electricity, OPPD and NPPD, are too small to take advantage of economies of scale that exist in power generation. Economies of scale are the cost advantages that a producer gains when more power can be generated on a larger scale with lower average costs. These savings are typically achieved by satisfying the demands of an entire market as fixed costs are spread out over more units of output.

Figure 5.1 compares assets and revenues per worker for OPPD, NPPD, MidAmerican Energy and the U.S. industry average. OPPD's assets and revenues per worker are 52.6 percent and 84.9 percent below the national average, respectively. Likewise, NPPD's assets and revenues per worker fall below the industry average by 37.5 percent and 66.6 percent, respectively.[42]

Figure 5.1: Assets and revenues per worker, OPPD, NPPD, MidAmerican Energy and U.S. industry



Source: Financial statements of OPPD, NPPD, and MidAmerican Energy; Mergent Online for industry

As a result of the smaller scale of Nebraska's power generators, their costs are higher. Table 5.3 contains ratios of operating expenses to operating revenues for electricity providers over the past five years. All companies listed by Mergent Online in addition to MidAmerican Energy, OPPD and NPPD were calculated. As indicated, the median industry ratio was 82.9 percent, which was well below OPPD's 89.0 percent and NPPD's 88.1 percent. Figure 5.2 shows operating expenses as a percent of operating revenues for OPPD, NPPD and the electric power industry from 2010 to 2014..

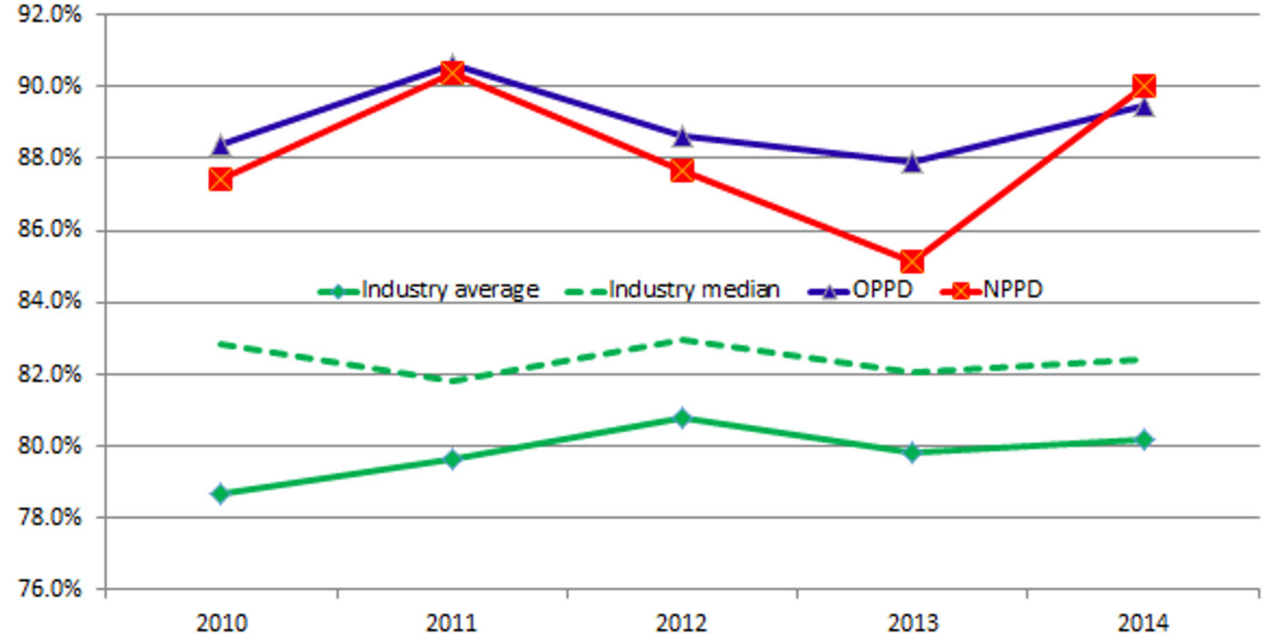
Statistical analysis of this data indicates that the lowest operating expense ratio is achieved at employment of 18,000, which is approximately eight times that of OPPD and NPPD. Economists have affirmed economies of scale in the electricity sector concluding that there were clear size advantages for the provision of electricity.[43]

Table 5.3: Total operating expenses as a percent of revenues and employment electricity providers, 2010-2014

Company	Operating expenses as % of revenues 2010-2014	Employment 2014
American Electric Power Company, Inc.	81.5%	18,529
Calpine Corp	86.2%	2,052
Consolidated Edison Co. of New York, Inc.	80.4%	13,200
Consolidated Edison, Inc.	82.6%	14,601
Consumers Energy Co.	83.7%	7,369
Dominion Resources Inc.	80.5%	14,400
DTE Energy Co.	85.6%	10,000
Duke Energy Carolinas LLC	75.6%	n.a.
Duke Energy Corp	81.0%	28,344
Edison International	85.9%	13,690
Entergy Corp.	84.4%	13,393
Eversource Energy	80.9%	8,248
Exelon Corp.	84.4%	28,993
Exelon Generation Co LLC	86.3%	14,370
FirstEnergy Corp.	88.8%	15,557
NiSource Inc. (Holding Co.)	72.3%	8,982
PG&E Corp. (Holding Co.)	86.7%	22,581
Public Service Enterprise Group Inc.	75.9%	12,689
Sempra Energy	28.1%	17,046
Virginia Electric & Power Co.	75.3%	6,800
Xcel Energy, Inc.	83.2%	11,589
MidAmerican Energy	88.5%	3,600
Industry median (including MidAmerican Energy)	82.9%	13,933
OPPD	89.0%	2,239
NPPD	88.1%	2,010

Source: Mergent Online & OPPD and NPPD yearly financial statements

Figure 5.2: Operating expenses as a percent of operating revenues, OPPD, NPPD and electric power industry, 2010-2014



Source: Financial statements of OPPD, NPPD, and MidAmerican Energy; Mergent Online for industry

Benefits of Privatization Monetized

Economies of scale. Assuming that via privatization, both OPPD and NPPD are able to achieve the industry average, savings are significant. As listed in Table 5.4, OPPD and NPPD would have saved an estimated $79.7 million and $85.7 million, respectively, for 2014.

Table 5.4 details the gains from achieving economies of scale. The gain is measured as the actual 2014 operating expenses of OPPD and NPPD minus the operating expenses for the producers if they were able to reduce their operating expenses as a percent of revenues to the industry median of 82.2 percent from OPPD's 89.5 percent and NPPD's 90.0 percent. As detailed, the gain would total $165.4 million for 2014.

Table 5.4: Estimated gain for OPPD and NPPD when lowering its operating expenses to the industry median, 2014 (economies of scale)			
	Actual 2014		
	2014 revenues	2014 operating expenses	Operating income
OPPD	$1,126,458,000	$1,008,058,000	$118,400,000
NPPD	$1,122,454,000	$1,010,693,000	$111,761,000
	2014 if achieve industry operating expense ratio		
	2014 revenues	2014 operating expenses	Operating income
OPPD	$1,126,458,000	$928,311,763	$198,146,237
NPPD	$1,122,454,000	$925,012,074	$197,441,926
	Gain for OPPD & NPPD from lowering operating expense to industry median		
OPPD	$79,746,237		
NPPD	$85,680,926		
Total benefit -economies of scale	$165,427,163		
Source: Goss & Associates calculations			

Property taxes Assuming that power generation is privatized in Nebraska, utilities would begin paying the relevant property tax rate rather than the current payments in lieu of taxes. As indicated in Table 5.5, the gain for local property taxing units would be $61.0 million for 2014.

Table 5.5: Property tax subsidy and payments in lieu of taxes, 2014					
Utility	Fixed assets or Personal property (net)	Property tax rate	Property tax If private	Payments in lieu of taxes (2014)	Net subsidy
OPPD	$3,346,861,000	0.0176	$58,904,754	$31,651,000	$27,253,754
NPPD	$2,495,206,000	0.0176	$43,915,626	$10,141,835	$33,773,791
Total	$5,842,067,000	0.0176	$102,820,380	$41,792,835	$61,027,545
Source: Goss & Associates analysis of financial statements of OPPD, NPPD and firms listed in Table 5.3					

Costs of Privatization Monetized

Currently, OPPD and NPPD are allowed to issue tax exempt bonds. Privatization would result in the loss of this financial benefit. Table 5.6 details the benefit of public power which is estimated to be $39.7 million for 2014.

Table 5.6: Interest expense avoided from issuing tax-exempt debt instead of taxable debt, 2014					
Utility	Total debt	Credit rating	Corp-Muni interest rate difference	Tax-exempt financing debt service savings	Net subsidy
OPPD	$2,328,935,000	AA	0.87768	$20,440,597	$27,253,754
NPPD	$2,098,188,000	A	0.91876	$19,277,312	$33,773,791
Total	$5,602,218,847			$39,717,909	$61,027,545
Source: Goss & Associates based on OPPD and NPPD financial statements and Yahoo Finance					

Net benefits for Nebraska electricity generation

Table 5.7 summarizes the net benefits of privatizing Nebraska's electricity power generation. As presented, it is estimated that privatization of electricity generation in Nebraska would produce a net benefit for the state of $186.7 million.

Table 5.7: Net 2014 estimated benefits of privatizing electricity power generation in Nebraska		
	Benefit	Cost
Economies of scale	$165,427,163	
Net increase in property tax payments	$61,027,545	
Loss of tax exempt bond status		$39,717,909
Totals	$226,454,708	$39,717,909
Net benefit	$186,736,799	
Source: Goss & Associates *This estimate does not take into account the operating returns that may leave Nebraska		

Possible Legislative Considerations

Currently, public utilities hold the right of first refusal for power-related development projects, especially transmission projects. This gives incumbent developers the right of first refusal when bidding on state transmission line projects, a situation which some politicians believe discourages a competitive bidding process.[44] The legislative environment in Nebraska, through its exclusion of non-incumbent private companies in in the bidding process for Nebraska's electricity projects, poses barriers to independent and private investment in the state.

Nebraska's public power monopoly discourages private investment in new power generation by rendering private companies unable to enter into power purchase agreements which could result in new development and infrastructure expansion. To increase competition in the bidding process, non-incumbent private companies should be welcomed and incentivized to bid on projects in Nebraska's electricity industry.

Summary

This section has detailed the gains and losses from the privatization of electricity generation in Nebraska. Gains are achieved by lowering operating costs as a share of revenue and by increasing property tax. Losses are incurred due to the loss of the ability to issue tax exempt bonds. It is also concluded that privatization of electricity generation is likely to reduce electricity price volatility and it would shift the potential political risks of electricity generation to private investors and away from Nebraska taxpayers.

Endnotes

1. This study was produced independent of Creighton University. As such, Creighton University bears no responsibility for any statements by Ernest Goss, Jeff Milewski or Goss & Associates.
2. West North Central (WNC) states as defined by the U.S. Census Bureau include the states of Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota.
3. http://www.omaha.com/news/long-idled-fort-calhoun-nuclear-plant-gets-green-light-to/article_88a063ea-e13b-5de5-a3cb-205d472e8a56.html
4. In 2014, OPPD's total operating expenses were $1,008,058,000.
5. It can be demonstrated mathematically that, optimum pricing strategies require that the firm, public or private, set prices highest in the market that is least price sensitive and lowest in the market that is most price sensitive. For electricity sales, numerous studies have concluded that demand for electricity by residential purchasers of electricity is much less responsive to prices changes than industrial users. http://www.sciencedirect.com/science/article/pii/S0378779608001272.
6. http://www.eia.gov/todayinenergy/detail.cfm?id=16231
7. http://www.neo.ne.gov/statshtml/182.htm
8. In a 2007, Nebraska, with 8.6 million acres of irrigated farmland, was tops in the nation and was well ahead of number two California with 8.0 acres of irrigated farmland. "Under contracts with utility companies, irrigation scheduling is arranged around electric peak-load times of electricity usage (late afternoons); thereby reducing the rates and making electricity the most cost-effective energy source." Department of Agricultural Economics, Report No. 190, September 2011, http://agecon.unl.edu/a9fcd902-4da9-4c3f-9e04-c8b56a9b22c7.pdf
9. http://update.legislature.ne.gov/?p=11167
10. Nebraska Power Review Board Orientation Manual http://www.powerreviewboard.nebraska.gov/prbmanual/3.html
11. http://www.powerreviewboard.nebraska.gov/prbmanual/2.html
12. Electric power companies in Nebraska do pay "payments in lieu" of property taxes, which are generally lower than property taxes paid by an otherwise equivalent private company.
13. With the shutdown of Fort Calhoun Nuclear Station in Nebraska, MidAmerican Energy supplied electricity to Nebraska.
14. LES, NPPD and OPPD are the largest retail electricity distributors in Nebraska, and serve a majority of the state's population.
15. With the shutdown of Fort Calhoun Nuclear Station in Nebraska, MidAmerican Energy supplied electricity to Nebraska.
16. The state level "adjustment" row includes an aggregated state-level estimate of sales, revenue and customer counts that include imputed values for non-sampled entities and reported values for retail power marketers. In the case of retail power marketers, their data are considered protected and not publicly released in identifiable form until nine months after the end of the reporting year. Also, the state-level adjustment is included in the aggregate state-level totals.
17. Projected prices are based on recent relationships between electricity prices and the share of electricity produced from coal as presented in the appendix at the end of section 2, Table A.1.

18. Subsidy is equal to total federal subsidies divided by the kWh for the source of electricity.
19. Estimates in this table assume that the full subsidy ends up in the kWh electricity price.
20. Pooled seven cross-sections and 14 years of data. Random effects model used.
21. http://www.oppd.com/business/business-rates/
22. It can be demonstrated mathematically that, optimum pricing strategies require that the firm, public or private, set prices highest in the market that is least price sensitive and lowest in the market that is most price sensitive. For electricity sales, numerous studies have concluded that demand for electricity by residential purchasers of electricity is much less responsive to prices changes than industrial users. http://www.sciencedirect.com/science/article/pii/S0378779608001272
23. Garen, John, C. Jepsen and J. Saunoris. "The Relationship between Electricity Prices and Electricity Deman, Economic Growth, and Employment," CBER Research Report, Gatton College of Business and Economics, University of Kentucky, 2008
24. Volatility is defined as the standard deviation of electricity prices per kWh over the time period. Standard deviation is measure that is used to quantify the amount of variation or dispersion in a set of data. A standard deviation close to 0 indicates that the data points tend to be very close to the average (little volatility).
25. Hanham 2000
26. Other industries, such as agriculture, would be computed equivalently.
27. The period 1998 to 2013 is selected for analysis since it is the longest period of time for which we have full and reliable data for both employment and electricity rates.
28. There was a mild recession in 2001 which began in March, but ended in fall quarter of the 2001.
29. According to the U.S. Bureau of Economic Analysis, "A location quotient (LQ) is an analytical statistic that measures a region's industrial specialization relative to a larger geographic unit (usually the nation). An LQ is computed as an industry's share of a regional total for some economic statistic (earnings, GDP by metropolitan area, employment, etc.) divided by the industry's share of the national total for the same statistic. For example, an LQ of 1.0 in mining means that the region and the nation are equally specialized in mining; while an LQ of 1.8 means that the region has a higher concentration in mining than the nation." LQ = (% of NE employment in food processing divided by % of U.S. employment in food processing).
30. http://www.eia.gov/todayinenergy/detail.cfm?id=16231
31. In a 2007, Nebraska, with 8.6 million acres of irrigated farmland, was tops in the nation and was well ahead of number two California with 8.0 acres of irrigated farmland. "Under contracts with utility companies, irrigation scheduling is arranged around electric peak-load times of electricity usage (late afternoons); thereby reducing the rates and making electricity the most cost-effective energy source." Department of Agricultural Economics, Report No. 190, September 2011, http://agecon.unl.edu/a9fcd902-4da9-4c3f-9e04-c8b56a9b22c7.pdf
32. http://www.neo.ne.gov/statshtml/182.htm
33. Sources: http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Farm_and_Ranch_Irrigation_Survey/ and https://www.eia.gov/todayinenergy/detail.cfm?id=16231
34. Standard deviation is measure that is used to quantify the amount of variation or dispersion in a set of data. A standard deviation close to 0 indicates that the data points tend to be very close to the average (little volatility).
35. http://www.eenews.net/interactive/clean_power_plan/states/nebraska
36. http://www.neo.ne.gov/statshtml/52.html

37. http://www.omaha.com/news/long-idled-fort-calhoun-nuclear-plant-gets-green-light-to/article_88a063ea-e13b-5de5-a3cb-205d472e8a56.html
38. In 2014, OPPD's total operating expenses were $1,008,058,000.
39. http://pbadupws.nrc.gov/docs/ML1100/ML110050081.pdf
40. http://www.kvnonews.com/2011/05/complications-as-cooper-nuclear-station-refuels/
41. http://journalstar.com/news/state-and-regional/nebraska/regulators-raise-concern-about-cooper-nuclear-plant/article_f60f5418-5922-55d2-99b0-cda46ff6bdf0.html
42. Power companies constituting the industry are listed in Table 5.3. These are all of the power companies listed in Mergent Online for NAICS 22111 (Electric Power Generation).
43. Farsi, Mehdi, Aurelio Fetz and Massimo Fillippini. "Economies of Scale and Scope in Multi-Utilities," The Energy Journal, Vol. 29(4), 2008, page 140.
44. http://update.legislature.ne.gov/?p=11167
45. A portion of OPPD's and NPPD's payments to local taxing units is for transmission and distribution assets. To that degree, estimates in Table 6.7 are larger than would likely be achieved if these assets are not privatized.

Appendix A: Researchers' Biographies

Ernie Goss is the Jack MacAllister Chair in Regional Economics at Creighton University and is the initial director for Creighton's Institute for Economic Inquiry. He is also principal of the Goss Institute in Denver, Colo. Goss received his Ph.D. in economics from The University of Tennessee in 1983 and is a former faculty research fellow at NASA's Marshall Space Flight Center. He was a visiting scholar with the Congressional Budget Office for 2003-2004, and has testified before the U.S. Congress, the Kansas Legislature, and the Nebraska Legislature. In the fall of 2005, the Nebraska Attorney General appointed Goss to head a task force examining gasoline pricing in the state.

He has published more than 100 research studies focusing primarily on economic forecasting and on the statistical analysis of business and economic data. His book Changing Attitudes Toward Economic Reform During the Yeltsin Era was published by Praeger Press in 2003, and his book Governing Fortune: Casino Gambling in America was published by the University of Michigan Press in March 2007.

He is editor of Economic Trends, an economics newsletter published monthly with more than 11,000 subscribers, produces a monthly business conditions index for the nine-state Mid-American region, and conducts a survey of bank CEOs in 10 U.S. states. Survey and index results are cited each month in approximately 100 newspapers; citations have included the New York Times, Wall Street Journal, Investors Business Daily, The Christian Science Monitor, Chicago Sun Times, and other national and regional newspapers and magazines. Each month 75-100 radio stations carry his Regional Economic Report.

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Jeffrey Milewski is a senior research economist at Goss & Associates. He received his master's degree in political economy from the London School of Economics and Political Science in 2013. He completed his bachelor's degree at Creighton University in 2007, having studied economics and finance. Milewski also has experience working in finance and as an entrepreneur. Recently, he has co-authored impact studies on a range of topics such as property-casualty insurance, highway expansion, cost/benefit analysis, and national sporting events.

Scott Strain is a senior research economist at Goss & Associates. He has worked as an economist and statistician for more than 20 years providing forecasts and analysis across a wide range of industries. Scott served as an industry economist, working in new product development regarding both quantitative and qualitative research. Scott was Senior Director of Research for an economic development agency, providing economic impact and tax incentive analysis to both private businesses and government entities. He served on the business advisory committee that worked with Nebraska state senators and the director of the state's Economic Development Department to develop the Nebraska Advantage Act – a comprehensive package of business incentives that has helped to add more than $6 billion in new capital investment and over 13,000 new jobs in the state of Nebraska since the Act's inception in 2006.