1.0 Introduction

Regardless of one’s perspective on issues as controversial as global warming, environmental sustainability, or America’s dependence on imported oil, over the course of the next five years Nebraska’s elected officials and utility directors will be compelled to address elements of these issues as they relate to the evolving pollution standards and the composition of Nebraska’s energy portfolio. The purpose of this report is to offer a contribution to a broader understanding of the issues at play in a manner that will present policymakers and elected officials with knowledge and degrees of latitude sufficient enough to craft meaningful responses to new federal pollution standards and their impact on Nebraska’s energy generation portfolio.

This report consists of three sections. The first section provides an overview of the State of Nebraska’s energy portfolio with extensive attention paid to the wind energy sector in comparison with the wind energy portfolios of other states in the region including Iowa, Kansas, South Dakota, and Minnesota. The areas of specific comparison are current wind generation totals, installed wind capacity in these states, the wind generation potential, wind generation capacity currently under construction, and the amounts of capital investment in wind generation. The next section explores the implications of the new EPA standards on CO\textsuperscript{2} emissions for coal-generated electricity facilities in Nebraska promulgated in 2015 by the Obama Administration. The report concludes with the exploration of two plausible future energy scenarios for the State of Nebraska. In this way, it is hoped that policymakers and elected officials can equally consider alternative modes of electricity generation into the 21st century that is both responsive and compliant with the federal pollution standards, environmental considerations, and economic stewardship of the state’s energy portfolio.
Nebraska’s Energy Future: Considerations and Challenges

Chart 1.0. Generating Nameplate Capacity by Energy Source, Nebraska, 2013


2.0 Nebraska’s Energy Portfolio and the Consideration of Wind Energy as a Generation Alternative

At present the state of Nebraska relies on coal-generation for almost half of its electricity generation capacity. This owes largely to energy generation technology that is both cost-efficient and readily accessible. This is also bolstered by relatively stable prices for coal and low transportation costs owing to Nebraska’s close proximity to major coal fields. It allows for Nebraska’s utilities to deliver electricity to its clients in both rural and urban settings that is both reliable and relatively inexpensive. But because of recent federal policy changes the status quo ante has been called directly into question. Without passing any new legislation. President Barack Obama could leave office with the most aggressive, far-reaching environmental legacy of any occupant of the White House. “Yet it is very possible that not a single major environmental law will have passed during his two terms in Washington. Instead, Mr. Obama has turned to the vast reach of the Clean Air Act of 1970, which some legal experts call the most powerful environmental law in the world.”

Moreover, elements of the new regulations have direct implications for Nebraska lawmakers that will mandate a response in the short-term and

could end up costing utility customers billions of dollars. “Mr. Obama is using the authority of the act passed at the birth of the environmental movement to issue a series of landmark regulations on air pollution, from soot to smog, to mercury and planet-warming carbon dioxide.”\(^2\) Because of Nebraska’s heavy reliance on coal-generated electricity and the demand that the state must reduce carbon emissions from coal by 40% by 2030 there is an unavoidable and daunting energy challenge facing Nebraska today.

A partial response to the challenge is to explore the possibility of shifting resources within the state to the development of wind generation capacity. Wind energy production, while initially costly, is considered a much more environmentally sustainable form of energy generation. This is not to negate the raft of other energy generation technologies presently being exploited or those whose development might produce even lower cost and environmentally friendly production capabilities. This report will focus only on wind energy largely because Nebraska has been called the “Saudi Arabia of wind” and because of the growing development of wind energy resources in the state.

### 2.1 A Regional Wind Energy Comparison

This section offers brief comparisons with other states in the region as they relate to wind energy including the following: installed wind generation capacity; total potential wind capacity; current wind generation capacity; wind generation capacity under construction; and total capital investment in the wind energy sector. As a quick drive across central and northern Iowa reveals, Nebraska’s installed wind generation capacity is dwarfed by that of Iowa’s. At present, Iowa’s installed capacity is over 5,500 megawatts (MW), Nebraska’s by comparison is barely over 500 MW. Even if Nebraska were to embark on an aggressive wind energy expansion, Iowa’s campaign over time to expand wind generation capacity will stand as the national leader for the foreseeable future. In terms of the percentage of wind energy of the total energy output from across the Midwest, South Dakota and Kansas are the regional leaders with 24% and 20% respectively. Nebraska lags last in the region with only 6% of its energy coming from wind power. When we consider the wind energy potential, there is a different story to tell. Nebraska is only surpassed by Kansas in total wind energy potential where it is estimated that Nebraska could conceivably produce up to 900 (k/mw) from wind energy sources. And yet, the less than 100 MW of potential wind energy clearly demonstrates that wind continues to be a grossly

\(^2\) Ibid.
underutilized source of potential for the state. Nowhere is this more dramatic than when we consider the potential for capital investment in the sector. In Iowa alone there has been in excess of $18 billion in capital investment in wind energy, with the lion’s share coming from sources outside of the state. By comparison, the amounts of capital investment going to Kansas and Minnesota ($8 billion each) are four times the amount of capital investment in wind energy in Nebraska ($2 billion in 2014).

From the purely economic assessment of the potential of wind energy generation it is abundantly clear that Nebraska has plenty of room for growth in terms of energy production but with significant inputs of capital investment into the state as well. The next section considers the potential environmental benefits that would be immediately available with shifts in energy generation capacity to that of wind energy.

2.1.1 Environmental Benefits

Generating wind power creates no emissions and uses virtually no water. When compared to other energy generation sources, the process of generating wind power uses very little if any water and *de facto* produces no carbon emissions. This is a paramount consideration given the new EPA standards when compared to all other sources of energy generation, but especially when compared to coal energy generation.

Furthermore, in a water-constrained state such as Nebraska, the annual state water consumption savings are significant. With just the limited exploitation of wind energy in the state’s portfolio the environmental benefits in 2014 were significant:

- State water consumption savings: 392 million gallons.
- Equivalent number of water bottles saved: 4,181,000,000.
- State carbon dioxide emissions avoided: 1.1 million metric tons.
- Equivalent number of cars taken off the road: 188,713. There are presently 2.2 million vehicles registered in the state.
3.0 Exploring an Energy Future Scenarios Matrix

Given the significance of the potential of wind energy generation and the daunting challenges of new federal energy emissions standards, it is worthwhile to consider what the future of energy might be given this mix of influences. The policy and intelligence communities make wide use of future scenario mapping as a means of assessing the plausible outcomes of critical questions as they might play out under certain conditions. Because we already know the potential of wind energy in Nebraska and the limitations placed on it because of new federal standards, it is a worthwhile exercise in our attempts to ascertain what the impact these changes might produce in the near term. What we do not know is the impact of many of the factors outside of our control if we are to have a clearer picture on which to base our scenarios. To do so, we must first identify the critical factors and driving forces that will influence and inform our analysis and assist us in determining which scenarios are the most beneficial to pursue or to avoid given our priorities.

3.1 Critical Factors and Driving Forces in Energy

In creating a future scenarios matrix or map we must be keenly aware of the critical factors and driving forces that contextualize and shape the environment in which we are operating and allow us to accelerate or slow the processes of policy change and response as needed. Below is an initial listing of the factors and forces that inform our assessment of the future of wind energy and the response to new regulatory standards in carbon emissions. The listing below is by no means comprehensive but it is illustrative of the most important factors and forces we can account for at this time.

- The collapse of the “fracking” boom – In large part, because of the drop in worldwide oil prices, the cost of fracking relative to the price of oil has rendered this process of petroleum extraction untenable. It costs more to produce than the market will pay.

- Global scope of petro-fuel prices – Oil and its derivative petro-fuels are global commodities meaning that the scale and price are set to global considerations and not to local ones. This is why fracking operations in the Bakken Fields of North Dakota and across segments of North America have ceased to operate. Fracking and similar technologies are price sensitive to the cost of extraction when subjected to global oil prices. While oil was being traded at $80 and $90 per barrel the boom was in full swing. With the price consistently under $50 per barrel in 2015, it made little sense to producers
to continue drilling and subsequently thousands of jobs have evaporated, and as quickly as it started, it has stopped.

• The specter of Fukushima – Nebraska’s nuclear power generation stations have been the source of significant speculation as to their integrity and safety given flooding, low operating capacity, and poor inspection regimes. As a stable source of energy the results of the recent past has been spotty and less than reliable. Given the public’s already wary attitude toward nuclear power and then the catastrophic impact of the tsunami at the Fukushima Nuclear Station in Japan, the timing for expansion of nuclear power generation is poor. It should be noted that there has been little public discussion of what Nebraska utilities will do when the life-cycles of their nuclear energy reactors reach their end of life.

• Cost tolerance – There has been some suggestion that many of the coal-generation facilities can be retro-fitted with scrubbers to reduce the amount of carbon emissions they produce. Studies suggest that the cost of such retro-fitting would be borne almost exclusively by utility customers and the result would only minimally reduce emissions at levels still far too high to satisfy the federal standards. There would be questions legitimately challenging whether there could ever be a responsible return on investment for the multi-million dollar costs of retro-fitting.

• Economic sustainability – An oft-heard complaint by utility customers is that of consumer price variability especially in less-energy-efficient older homes, for customers with little or no extra cash on hand when fuel prices spike, or during extreme weather seasons. These are constants, and it is highly questionable that customers alone could support dramatic price fluctuations or increased costs owing to investment costs in the form of bonds borne by the utility alone.

• Government regulations – The requirement of Nebraska to reduce its carbon emissions from coal energy generation by 40% by 2030 seems almost impossible unless it begins taking these facilities off-line today. It raises the questions of what will Nebraska turn to and who will pay for the change.

• Environmental considerations – The 40% carbon emissions reduction standard is a necessary step in the reduction of greenhouse gases and may help to stave off the worst implications of climate change.
• Investment opportunities – The shift to wind energy will draw investors from both inside and outside of Nebraska. Production, construction, and transportation companies will be drawn to being part of an industry that has the potential of growing twenty times over its current value and will significantly increase the diversity of Nebraska’s energy portfolio while decreasing its carbon emissions. It would also draw in the latest innovations in wind energy technology, including but not limited to the newer oscillating turbine technology that addresses the concern of the harm to birds from the present and widely-used blade generation technology.

From these important elements two issues emerge as critical factors and driving forces in state energy policy moving forward:

• **Cost tolerance** – How much in operational costs will energy producers be willing to tolerate?

• **Economic sustainability** – At which point does the cost of operation become untenable and/or unsustainable?

3.1.1 Focal Question

As we develop our scenarios matrix, we have identified the two factors that will serve as the axes of our two-by-two matrix. Moreover, we are compelled to distill our concern into a simple yet essential question that will drive our inquiry. As such, our focal question is stated below.

• **How will the new EPA regulations impact coal-generated electricity in Nebraska over the next 15 years?**

The question is limited to a 15-year timeline because 2030 is the deadline for compliance with the new EPA standards. It should also be noted that new EPA standards for natural gas generation will be released within the next six months and we should anticipate that they will be no less onerous that those for coal generation are proving to be.

3.1.2 The impact of new EPA standards

To clarify the discussion, we articulate the direct impact of the new standards, Nebraska will be required to reduce its total output of CO\textsuperscript{2} emissions by 40% by the year 2030, with a plan
submitted to the EPA by 2018. Nebraska relies on coal-generated electricity for nearly half (47.5%) of its total energy supply.

- This means we must cut carbon emissions from 49.9 million metric tons to approximately 30.0 million tons in a 12-year period.

- It will require a radical reconfiguration of Nebraska’s energy portfolio whereby the total emissions generated by coal-generation facilities will have to be cut by more than half. How does Nebraska accomplish this in a manner that conforms to the new EPA standards while simultaneously transitioning to alternative energy sources or aggressively retro-fitting the facilities with scrubbers to reduce the emissions?

- There is no guarantee as to whether retro-fitting the coal-generation facilities are sufficient to meet the standards; or, more importantly to the utilities themselves, where the significant investment capital will come from.

3.1.3 Some basic assumptions

- By 2018, the Supreme Court will uphold the EPA regulations. It is commonly acknowledged that the Clean Air Act of 1970 is among the strictest and most enduring pieces of environmental legislation in the world. Up to this point, it has survived numerous legal challenges. In spite of the raft of current suits against the new EPA standards by a number of states, Nebraska included, this is little precedent to suggest that anything will come of the challenge. In recent court rulings, the Supreme Court has sided with the EPA on other environmental standards promulgated by executive action while tied to pre-existing law, as the EPA standards for carbon emissions are tied to the Clean Air Act of 1970.

- This will compel states to immediately respond to the requirements for instituting a plan that includes implementing a **Renewable Portfolio Standard** (RPS) which is a regulation that requires the increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal. Another common name for this requirement is **Renewable Electricity Standard** (RES) at the federal level.

- Presently Nebraska has neither an RPS nor a goal in place.
• **Economic studies supports coal plant phase-outs over retrofits** - In March 2010 Natural Capitalism Solutions, an environmental advocacy group based in Longmont, Colorado, released a report that favored phasing out existing coal plants over retrofitting them with scrubber technology. The report titled, “Coal Plants in Transition: An Economic Case Study,” provided a proof of concept for utilities to consider as they evaluate investments in new generation capacity and upgrades to existing facilities. “We are quickly entering a water- and carbon-constrained world, and we wanted to look at what options might be available to utility managers and other energy providers,” said Paul Sheldon, a senior consultant at Natural Capitalism Solutions and the report’s main author. “We believe that these findings represent a business approach for energy managers to consider as they are faced with difficult decisions regarding the future of their facilities. We’ve shown that this approach allows them to maintain reliability and still profit in their transition to 21st century energy technologies.”

Using the 35-year old, 2,250-megawatt Navajo Generating Station near Page, Arizona, as a case study, the group’s analysis examined the costs and benefits of the plant’s future. As with many aging power plants nationwide, Navajo is due for upgrades necessary for it to comply with the EPA's pollution and air quality regulations. The report notes that retrofits can entail substantial costs, running into the hundreds of millions of dollars. The report states that such facilities, in order to protect jobs and move in a more environmentally safe direction, will be more profitable by abandoning retrofit plans and instead embracing a full range of clean energy resources, including wind, photovoltaic and concentrated solar, geothermal, and biomass, combined with large-scale supply and demand-side efficiency measures.

### 3.2 Scenarios Matrix

As can be seen in Figure 1, the two critical factors **Cost Tolerance** and **Economic Sustainability** for our focal question have been placed on the x and y axes of the matrix, respectively. I then assign characteristics of each of the quadrants of the matrix as they relate to not only the two critical factors, but also incorporate the other critical factors and driving forces from the original list. In Figure 2, I have assigned scenario titles that describe the policy environment in which policymakers and elected officials are operating. For instance, I give

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4 "Coal Plants in Transition: An Economic Case Study" Natural Capitalism Solutions, March 2010.
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Scenario 3: Hard Left Rudder attributes akin to what one might hear in a trailer at the local theater. In a deep booming voice the narrator begins:

“This is a world where:

- Nebraska has decided to not abide by the EPA regulations until compelled to do so.
- The cost of conversion and retro-fitting its coal-powered electricity generation facilities is an unfunded mandate.
- Costs will be devastating regardless of the path chosen.
- Consumer cost per kilowatt/hour will skyrocket.
- What will the Nebraskans do?”

In this case, policymakers have selected an environment that allows for high cost tolerance and promotes environmental sustainability weakly. This is not to say this is the course that policymakers will select. What this descriptor does is to allow policymakers the ability to explore the implications of actions taken in that particular quadrant undertaken within that particular environment. Under this scenario, few if any of the choices are optimal and they would almost universally require reactive responses to the decisions undertaken in the scenario.

We can repeat the process with Scenario 1: Steady As She Goes:

“This is a world where:

- Nebraska has laid out a renewable portfolio standard for all utilities.
- The state has promoted the development of renewable energy industries.
- Wind power is emerging as a realistic energy generation alternative for all utilities.
- Investment in alternative energy development has increased dramatically.
- Cost per kilowatt/hour drops as Nebraska cuts its coal consumption and subsequently its carbon emissions.”
In both cases, we have the ability to explore the implications of a particular path chosen to pursue. It is not definitive by any means but it allows us to explore the universe of possible and plausible courses of action that might be taken and to seriously consider the implication of those courses.

**Figure 1. Scenarios Matrix**

![Scenarios Matrix Diagram]

**Figure 2. Scenarios Come To Life**

![Scenarios Come To Life Diagram]
4.0 Conclusions

Nebraska’s public utility policymakers, elected officials, and investment capitalists will be challenged by the requirements of the new EPA standards for carbon emissions produced by coal-generated electricity facilities across the state in the near term. In fact, it will be required to formulate a plan by 2018 and meet those standards by 2030. This report has been structured to allow elected officials to explore the range of alternatives to coal generation with a specific focus on wind energy. This in no way represents the entire universe of options available to policymakers, but it realistically highlights the limit that electricity produced through coal generation has given the new EPA standards. It suffices to say that this is a colossal challenge that could be viewed also as an opportunity, as it opens the range of energy alternatives that could be both economically beneficial and environmentally sustainable. It is by no means a comprehensive or exhaustive report but it does represent a serious commitment to providing a basis of understanding of issues that are complex and deeply embedded in Nebraska’s well-being, and may require a radical response in terms of the degrees of change that it will incorporate.
Appendix 1: Additional Charts

Chart 1: Nebraska’s Energy Portfolio


Chart 2: Installed Wind Capacity

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Chart 3: Current Wind Generation

![Chart 3: Current Wind Generation](http://www.awea.org/resources/statefactsheets.aspx?itemnumber=890)


Chart 4: Wind Generation Potential

![Chart 4: Wind Generation Potential](http://www.awea.org/resources/statefactsheets.aspx?itemnumber=890)

Chart 5: Wind Generation Capacity Under Construction


Chart 6: Capital Investment in Wind Generation