Husker Energy Plan for Electric Utilities

Nebraska's electricity comes from power plants that burn coal, gas and oil (fossil fuels); nuclear power plants that generate heat from nuclear fission; and increasingly from renewable sources like wind, solar, landfill gas, and hydroelectric power.

Coal, natural gas and oil are not renewable; there is a limited amount of fossil fuels on earth. As we use up the cheapest, most available sources, remaining resources get more and more expensive to find and develop and use greater amounts of energy to extract.

Nebraska produces no coal, very little oil and a tiny amount of natural gas[i]. Nebraska utilities paid $356 million for the cost of mining and delivering coal to power plants in 2014[ii], and much of that left the state, supporting jobs elsewhere.

There is a better way.

Nebraska's Clean Energy Future

As Nebraska moves away from fossil fuels like coal and gas to generate electricity, there are opportunities to produce most or all of our electricity from in-state sources. The goals of our Husker Energy Plan for the electric utility sector are to:

- Reduce air pollution from power-plants that is killing and sickening Nebraskans.
- Ensure a sustainable, affordable system for generating our electricity for future generations.
- Reduce Nebraska's use of out-of-state coal, keeping money and jobs in Nebraska.
- Reduce pollution produced by Nebraska's utility sector that has been linked to climate change.

A clean energy future for Nebraska's electric utility sector could be built around five pillars: Immediate investments to (1) reduce energy use and generating capacity needed and (2) add clean renewable energy as outlined in this plan, then (3) energy storage and smart grid investments, (4) using cogeneration and district energy solutions to make more efficient use of energy, and (5) closing coal-fired power plants starting with the oldest and most polluting.

Reducing Pollution

Our state's heavy reliance on coal to generate electricity has important implications for the air we breathe, the health of our citizens, and for our climate.

When fossil fuels like coal and natural gas are burned, they release a mix of sulfur dioxide, nitrous oxides, carbon dioxide, carbon monoxide, mercury and other heavy metals, particulates, and volatile organic compounds into the air. Sulfur dioxide, carbon monoxide, nitrous oxides, and particulates all cause health problems in people, including asthma, respiratory illness, and heart disease[iii]. Mercury is a neurotoxin that causes health problems in humans and wildlife. There are 142 lakes and streams in Nebraska that now have fish consumption advisories, primarily due to mercury contamination[iv]. Acid rain from sulfur dioxide and nitrous oxides can poison our state's rivers and lakes, and our oceans.

Carbon dioxide and nitrous oxides from electric utilities are some of the largest sources of greenhouse gases that contribute to climate change. Climate change is already having a negative impact, and if it continues unchecked will likely result in hotter temperatures, more evaporation, and abnormal rainfall and snow patterns in Nebraska[v].

There is a better way.

Our Husker Energy Plan would reduce the pollutants that are now sickening and killing Nebraskans, and reduce Nebraska's contribution of greenhouse gases that are causing climate change, by sharply reducing the need to burn fossil fuels like coal that now power our electric utilities.

Managing Demand and Energy Use

Nebraska is the seventh highest state in energy consumption per person[vi], so we have lots of opportunity to reduce our state's energy consumption. Nebraskans spent $10.4 billion in 2014 and $8.2 billion in 2015 purchasing energy.

Across America, our current system for delivering energy services is very inefficient. Energy economists say our current energy economy is only 14% efficient; meaning some 86% of the energy used in America is wasted[vii]. Much of that energy is lost to inefficiencies in vehicle engines, light bulbs, motors, appliances, and inefficient buildings, and some of that energy is used to transport coal or gas long distances to where it is used. That wasted energy inflicts a huge burden on our economy, but it also represents a great opportunity to reduce our energy use and cost.

The cost of *energy efficiency* investments needed to reduce energy use is very low. Reports by Nebraska electric utilities and the American Council for an Energy Efficient Economy estimate the costs of energy efficiency at 1¢ to 5¢ per kilowatt hour, and is typically around 2¢ per kWh, compared to 2¢ to 10¢ per kilowatt hour to generate the electricity from existing power plants (and even more from most new power plants)[viii].

Investments to replace old inefficient light bulbs, motors and appliances, weatherize buildings, and update space heating, air conditioning and water heating systems can have short paybacks, from a few months to a few years. Changing people's behavior can save energy with little or no investment, and can be inspired by small changes like providing information on bills that show how a customer's energy usage compares with others in their neighborhood[ix].

In Nebraska demand for electricity peaks during hot summer months when air conditioners and irrigation pumps are running. At those times, power plants that run on oil or natural gas are called on, providing more expensive power to meet those peak needs. *Demand management* investments can reduce the need to use that high-cost power, and reduce the need to have expensive generating capacity in place.

In 2014, Omaha Public Power District announced a goal to reduce OPPD's expected need for capacity by 300 MW through demand management programs and investments.

Some changes reduce both the need for peak capacity and the amount of energy consumed. For example, insulation for homes and buildings reduces energy usage any time there is a need for heating or cooling a building, and also reduces the need for energy during the hottest (or coldest) times of the year when usage peaks. Reports by Nebraska electric utilities and the American Council for an Energy

Efficient Economy say the cost to reduce those peaks typically is much less than the cost to build a new power plant that would otherwise be needed to meet those peaks.

Energy efficiency and demand management investments are important parts of our clean energy strategy, because they reduce the inefficient use of energy and allow Nebraska's energy needs to be met with fewer generating resources. Fortunately, studies by Nebraska utilities and efforts by utilities in other states have shown that there are wide-spread opportunities for cost-effective investments in energy efficiency and peak demand management.

Electric (and natural gas) utilities often view ***peak demand management*** investments differently than ***energy efficiency*** investments. By reducing the need for expensive new (or existing) capacity, peak demand management investments reduce costs to the utility, providing a net return to the utility. Ultimately public power utilities pass those savings on to each utility's customers.

Energy efficiency programs reduce the need for our public power utilities to generate electricity, so they reduce fuel and other costs to the utility needed to generate electricity. However, they also reduce retail sales to the utility, and the revenue lost is generally more than the reduction in generating costs. Many utilities are reluctant to pursue aggressive energy efficiency programs that would help their customers save money and reduce their energy use, because of the potential loss of retail revenue.

To achieve the levels of energy efficiency needed to move Nebraska towards a clean energy future, we think Nebraskans will need to rely on more than just our natural gas utilities and public power electric utilities. We will need to enlist municipalities, counties, civic and non-profit organizations and community leaders, backed by state resources, to organize and lead these efforts. Electric utilities will continue to have an incentive to pursue cost-effective peak demand management investments, and they should be involved in energy efficiency efforts to help the utility obtain maximum peak demand management benefits from the energy efficiency initiatives. Financing can come from sources like Property Assessed Clean Energy financing and the Nebraska Investment Finance Authority. Utilities could help by providing loan repayment options for customers through their utility bill.

Public power utilities can also help lead the transition of our transportation system to clean energy, with a commitment to providing needed infrastructure and promoting the use of electric vehicles. That would help reduce air pollution linked to health problems and climate change. With planning, utilities might be able to tap into vehicle batteries when not in use to provide electricity for the grid to meet peak demands in the future. And the cleaner the energy used by utilities to produce electricity, the cleaner the power will be that supplies the electric vehicles.

Through our Husker Energy Plan, Nebraska would:

> ◊ **Put in place comprehensive community-driven energy efficiency strategies, and utility-driven peak demand management programs designed to ramp up over several years, reaching the ability (by the fifth year of the plan) to deliver 2% annual reduction in electricity (in MegaWatt hours, or MWh) and natural gas consumed through energy efficiency measures, and to deliver 1.3% to 2% annual reductions in the peak demand for electric generating capacity needed (in MegaWatts, or MW), both measured against current utility projections for the future[x].**

At that level, over the coming years our plan would fully offset the slow growth in electricity consumed that is now projected by our utilities. If continued at that 2% annual reduction level in the future, over the next decade the strategies would result in a net *reduction of about 13% in electricity* consumed annually, and a substantial reduction in the generating capacity needed to meet annual peak demands for power, from current levels. The reduction in energy consumed could result in a savings to Nebraska electric utility customers that could grow to over $400 million annually by year ten of our plan, with a cumulative savings of over $2 billion over those ten years.

The reduction in natural gas use from many of the same measures (weatherizing homes and businesses, and upgrading older inefficient furnaces and water heaters) would result in a savings to Nebraska residential and commercial natural gas customers that could grow to over $80 million annually by year ten of our plan.

The investments needed in strategies like weatherization of homes, small businesses and other buildings, installation of energy efficient lighting, heating, cooling, motors, and appliances would generate jobs throughout the state. The reduction in generating capacity and energy needed will be offset in part by new load from the transition from gas to electric cars and light trucks. That load would provide additional revenue for electric utilities which would help offset the loss of revenue due to efficiency efforts.

Based on assessments by the American Council for an Energy Efficient Economy[xi], energy efficiency strategies that would lead to a 2% annual reduction in energy use (MWh) could also produce an annual reduction in peak load demand (MW) of about 1.3% annually. Additional peak demand reduction strategies, such as air conditioner controls, better irrigation scheduling, and interruptible service agreements could supplement those gains to achieve a 2% annual reduction in peak load from current utility projections. Because those strategies tend to be utility-specific and depend in part on industrial customers, the utility consultants reviewing our plan have not attempted to estimate costs and savings of reaching a 2% annual reduction in peak load, but have indicated the energy efficiency strategies assessed should achieve the level of 1.3% annual reduction in peak load.

Renewable Energy

Nebraska's wind, sun and moving water provide far more energy than we use. The U.S. Department of Energy says over 90% of Nebraska has wind that would produce reasonably good wind energy. The 45% average capacity factor of wind projects in Nebraska is the highest of any state, according to the American Wind Energy Association[xii]. Nebraska ranks 13th in the nation in potential solar energy capacity according to the National Renewable Energy Laboratory[xiii], and based on available hours of sunlight and cloud cover, the solar PV (PhotoVoltaic) potential in central and western Nebraska is similar to that in west Texas. Nebraska utilities have long made use of hydroelectric energy, which powered some of the first municipal electric systems in Nebraska and continue to serve us today.

Our utilities are now making more and more use of wind, solar, and landfill gas, and with good reason: the cost of wind energy has dropped by 66% over the past six years[xiv], and prices for utility solar energy power purchase agreements have dropped by 75% over the last seven years[xv]. The technologies continue to improve, so the cost of both wind and solar energy is expected to continue to drop.

Wind energy supplies an increasing share of Nebraska's electricity, and could supply much more. Industry sources say recent bids for power purchase agreements from Nebraska wind farms are in the range of 1.5 to 2.0 cents per kWh – as cheap or cheaper than can be generated from Nebraska's fleet of coal and natural gas power plants. Adding substantial new wind energy to Nebraska's electricity mix would save Nebraska utility customers money, create jobs in rural communities, keep more of our energy dollars in-state, and deliver cleaner, renewable energy for Nebraska.

New wind turbines are bigger and more efficient, allowing them to generate power with a capacity factor of 45% or more[xvi]. Wind farms cannot guarantee when the wind will blow, so the Southwest Power Pool (SPP) initially gives utilities credit for just 5% of a wind farm's total capacity in meeting a utility's peak demand. With three years of actual operating experience, the SPP will use actual data in calculating that credit. Nebraska industry sources indicate that new wind farms are likely to get credit for 15% of their total capacity in meeting peak demand once they establish a track record.

Through our Husker Energy Plan, Nebraska would:

> ◊ **WIND: Add 1,500 to 1,850 MW of new wind energy over the next 5 years to the 1,520 MW in place or under construction serving Nebraska[xvii], reaching roughly 3,000 to 3,400 MW of total installed wind capacity serving Nebraska. At that level, by 2023 wind farms would generate around 40% of Nebraska's anticipated MWh usage. At a 15% average accredited capacity, it could also allow recent and new wind farms to replace the equivalent of 500 MW of older coal-fired generating capacity.**

The proposed level of new wind development is similar to the levels of wind added in recent years in Nebraska, and substantially less than is being added in states like Iowa. We would expect that most new wind farms would be located in Nebraska, but some could be located out of state to provide geographic diversity in wind generation. Nebraska utilities now have joint agreements with out-of-state utilities for fossil fuel generation, and Nebraska utilities could pursue joint wind farm agreements with utilities in other states to take advantage of wind siting diversity and potentially increase the average accredited capacity of the wind fleet. First preference should be given to in-state wind generation, however.

Fortunately, much of Nebraska has very strong wind energy potential. There are areas of the state where wind farms would have high impacts on wildlife or other resources – such as the Central Platte Valley, the Niobrara National Scenic River, or near Rainwater Basin wetlands – but there are many parts of Nebraska with very low potential wildlife impact, very good wind, and access to transmission lines. As Nebraska closes surplus coal-fired power plants in the future, even more transmission line capacity would be freed up in the many parts of the state where wind is abundant.

Nebraska has opportunities and local interest in both smaller community-scale wind farms and larger utility-scale wind farms. Larger wind farms may gain some economics of scale, but smaller community-scale wind farms may be better able to take advantage of local community support and opportunities to connect to the grid in areas with limited excess transmission capacity.

Solar energy delivered only a small share of Nebraska's electricity needs in the past, but the price of solar energy has been falling rapidly. In Nebraska, the cost of utility-scale solar projects is now below $2 per watt[xviii]. To date, Nebraska has nearly 25 MW of solar installed, and the largest installations are the City of Kearney/Nebraska Public Power District 5.8 MW solar farm and the Lincoln Electric System solar farm just west of Lincoln, about 5 MW.

Many communities already see the benefits of solar energy, and are organizing community solar projects all around the state. Local businesses and residents are signing up to receive power from the projects. Community solar projects provide opportunities for residents or businesses even if they don't have a good location to mount solar panels.

The cost of installed rooftop solar systems, like those on residential homes and small businesses, has also continued to decline. Solar companies report that the installed cost of rooftop solar has fallen to about $3.50/watt, and federal tax credits could reduce that cost to around $2.45/watt. On farms and ranches, solar can be installed even more cheaply on ground-mounted systems.

Solar delivers more electricity during the long, hot summer days when electricity demand in Nebraska is highest due to demand from air conditioners and irrigation pumps. The Southwest Power Pool gives Nebraska utilities just 10% capacity credit for utility-scale solar energy that is fed into the grid when initially installed. Solar installations to date, however, have been 'behind the meter', meaning they operate to reduce demand for the utility by providing power for local distribution, not supplying power into the grid. That approach would mean Nebraska utilities could get the full advantage of the impact of new solar facilities in reducing summer peak demand.

Through our Husker Energy Plan, Nebraska would:

> ◊ **SOLAR: Add 129 to 150 MW of utility-scale and community solar over the next 5 years. At that level, by 2023 solar would generate nearly 0.3 million MWh of electricity, about 1 percent of the electricity sold by utilities in Nebraska**.

As Nebraska moves forward towards our clean energy future, there are other alternatives to explore.

Hydroelectric power was one of the first sources of electricity powering Nebraska, and it is still provides 3% of Nebraska's electricity. Building a large new hydroelectric dam would be costly and difficult, and could impact fish and wildlife habitat and downstream municipal water use. However, Central Nebraska Public Power & Irrigation District generates power at hydropower plants with about 63 MW of capacity along its irrigation supply canals, which is currently sold under contract to Kansas City Power & Light.

That electricity was once sold to Nebraska Public Power District, and when the contract expires with Kansas City Power & Light, it could once again be sold and used in Nebraska, providing affordable, renewable energy for Nebraskans.

Waste to Energy -- Nebraska's two largest landfills (Lancaster County and Douglas County) are already using technologies to capture and use the methane generated by biological processes in the landfills. Those two projects provide about 11 MW of capacity now used by Lincoln Electric System and Omaha Public Power District. However, it appears that no more than about 10 MW more electric generating capacity would be available in the remaining landfills elsewhere in the state.

Energy Storage

While wind and solar energy supplies can be predicted, they cannot be turned on or off to meet changes in demand. Energy storage strategies can provide a cost-effective means of matching electricity demand with our renewable electricity supply. Pumped hydro storage is already widely used in the United States to store energy. Compressed air is already in use in Alabama, and Nebraska appears to have at least one location where the geologic formation has strong potential to store energy in the form of compressed air, to be released to generate electricity in conjunction with a natural gas turbine when needed.

Utility-scale batteries are in development (and in some cases, production) that can store energy. Batteries have an additional benefit in that they can provide electricity with an immediate response. That is an advantage over, for example, coal and gas steam plants that typically take hours to ramp up to production, or natural gas turbine peaking plants that can take minutes to respond.

Over the next ten years, we expect Nebraska utilities to have increasingly affordable options for energy storage that would complement the addition of wind and solar energy, and allow for the closure of older, outdated coal-fired power plants. Those opportunities include:

> **◊ COMPRESSED AIR: NPPD started to investigate a 300 MW Compressed Air Energy Storage facility in southwest Nebraska, but released its option on the site before doing the geologic studies needed to determine if the site would work to store compressed air. The site is an old natural gas dome which is now used to store natural gas. We believe other utilities could be interested in the site. In its 2012 Integrated Resources Plan, NPPD's analysis provided cost estimates that appear competitive with the cost of building a new natural gas power plant.**
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> **◊ PUMPED HYDRO: There are many examples of pumped hydro energy storage projects in operation or in development. In times of cheap or excess energy, water is pumped up into a reservoir, and when power is needed water is released through a turbine, generating electricity.**
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> **◊ BATTERY: Utility scale batteries are an increasingly competitive option, and the technology is rapidly improving. GTM Research, which tracks the industry for the Energy Storage Association, expects as much as 1,800 MW of battery storage to come online in the US by 2021, 8 times as much as is now in place[xix].**

There are other ways to store and recover energy. Using energy to separate oxygen from hydrogen in water (H_2O) produces hydrogen that can be stored and used in a fuel cell to generate electricity. At least one Omaha bank is using fuel cells as emergency backup power, and the fuel cells have an added advantage of immediate response.

While there are a number of options, we focused on the alternatives above (compressed air, pumped hydro, and battery storage) because the technology is already available and in use, and – in the case of battery storage – the cost seems to be falling rapidly. Nebraska utilities should gain additional knowledge of these energy storage opportunities and work towards acquiring substantial energy storage capacity over the coming decades.

Smart Grid

Communication and control technology has become cheaper and more readily available, and we see tremendous opportunity for "Smart Grid" applications from the generation/transmission end to the retail end of the system to help manage, reduce and shift energy use and demand to match supplies. As we transition to more intermittent generation like solar and wind, those Smart Grid technologies will become increasingly valuable.

In addition to reducing consumption through energy efficiency and reducing peak demand through demand management (noted above), we see opportunities to better match demand with available supplies to take advantage of Nebraska's abundant wind and solar energy. For example, center pivot irrigation systems generally don't need to run continuously. Using available communication and control technology to schedule irrigation to take best advantage of available wind and solar energy would reduce the cost of delivering the energy needed while still delivering water when needed for crops.

Many of our electrical energy needs – from appliances like water heaters, air conditioners, and washer/dryers to chargers for electric vehicles and chillers for commercial cooling -- can be met through flexible scheduling. New smart grid technologies and inexpensive communication and control technology, combined with reliable forecasting of wind speeds and available solar energy can allow utilities to better match flexible load with available energy supplies.

Hydrogen

HYDROGEN – NPPD is moving ahead in partnership with Monolith Materials to convert one unit of Sheldon Station, a coal-fired power plant near Hallam, to burn hydrogen. The hydrogen would be a by-product of a new carbon black production facility being built by Monolith next to Sheldon Station. The new facility will use natural gas to produce carbon black, a much cleaner process than is now typically used (producing carbon black from oil). The project is underway, and our plan assumes it will be completed and fully operational by year five of our plan.

If the project is successful and Monolith decides to expand or build another production facility, there is the potential to convert the other unit at Sheldon, or one of the small coal-fired municipal power plants at Fremont, Grand Island, or Hastings. We did not include conversion of a second unit in our plan because of the uncertainties, although it has the potential to convert 100 to 150 MW of coal-fired capacity to hydrogen.

Co-generation and District Energy

CO-GENERATION refers to projects that make multiple uses of energy. That can be by capturing waste heat from an industrial process to create steam to generate electricity, or using the waste heat from electric generation to provide useful heat. The technology is widely used in other parts of the USA, and provides affordable options to add small chunks of capacity. Nebraska has a number of industrial facilities that could be opportunities for co-generation, including 25 ethanol plants which use heat generated by natural gas (or in one case, coal) to 'cook' the mash and dry the distillers grain, generating quite a bit of waste heat. At least a handful of ethanol plants in other states use cogeneration to capture the waste heat and turn it into electricity. Other potential facilities include the Nucor steel plant near Norfolk and several food processing plants. In Seattle, waste heat from a Nucor steel plant will be used to generate electricity for Seattle City Light.

Nebraska's public power utilities have mostly left the responsibility for financing and installing co-generation systems to their customers. That may make sense when output from the cogeneration project is all used on-site. Where enough power is generated to put power into the grid, it may make more sense for the utility to have a primary role. Nebraska utilities should be more proactive, helping finance, install and operate the electric generation side of new cogeneration systems, to provide ease and incentives for installation of cogeneration capacity.

DISTRICT ENERGY – Lincoln has a district energy system which provides heating and cooling to city and state buildings, and is now expanding to provide service to private companies in Lincoln's Haymarket neighborhood. In Omaha, NRG Energy, a private company, provides energy-efficient district heating and cooling for the downtown area, including Creighton University, Creighton University Medical Center, Woodman Tower, and more than 70% of the public and commercial buildings in downtown Omaha. These systems make more efficient use of energy.

> **◊ CO-GENERATION AND DISTRICT ENERGY– We see substantial opportunities state-wide for new co-generation and new or expanded district energy projects over the next 10 years, and Nebraska utilities and communities need to actively pursue these opportunities.**

Close the Oldest and Dirtiest Coal-Fired Power Plants

Nebraska currently has an excess of generating capacity, over and above that needed to meet our capacity obligations to the Southwest Power Pool. Even after the closure of Fort Calhoun Nuclear Station in 2016, Nebraska had over 800 MW of excess capacity in place, according to the Nebraska Power Association *2016 Load and Capability Report*. As we invest in energy efficiency and demand management to reduce energy use and peak demand, and add affordable wind, solar and energy storage, aging coal-fired power plants will no longer be needed to meet our electricity needs.

With the rising cost of delivered coal, flat wholesale prices received by utilities for the electricity they generate, and pollution problems from coal-fired power plants, coal-fired power is becoming a growing burden on Nebraska utilities and their customers. Coal and natural gas power plants also present substantial risks for future increases in power prices, since a large proportion of the cost to generate electricity – especially from a gas plant – is in the fuel. In contrast, once wind and solar farms and energy efficiency measures are in place, the fuel cost is zero and the operating cost is very low. Moving more rapidly towards clean energy supplies will give Nebraska utility customers more certainty and stability in their future electricity prices.

Starting with the oldest power plants first, Nebraska utilities should begin now to plan, phase out and close coal-fired power plants that are no longer needed. Advance planning would allow time for transition planning to help employees and communities deal with the changes, and reduce potential stranded assets from utility financing used to build the plants. All but a few Nebraska power plants were built before modern pollution control technologies, so they emit many times the levels of harmful pollutants compared to newer power plants. For example, when Omaha Public Power District's Nebraska City 2 power plant opened in 2009, utility officials said it would put out one-tenth the level of key pollutants as the similarly sized Nebraska City 1 unit built 30 years earlier. Unfortunately, Nebraska City 1 is still operating, despite putting out much higher pollution levels.

The first to close would likely be the oldest, including North Omaha units 1-3 which OPPD already plans to close (to allow units 4-5 to be switched over to natural gas). Sheldon Station unit 1 (1961), Lon Wright in Fremont (1977), Nebraska City 1 (1979), and Gerald Gentleman 1 (1979) are the next oldest coal-fired power plants and could be closed in the future as demand management, renewable energy, and energy storage/Smart Grid investments come online.

Over the next 10 years, Nebraska should begin to right-size its fleet of power plants. As that happens Nebraskans would breathe much easier, because those older plants don't have modern pollution-control systems in place, so they spew many times the level of pollutants like mercury, sulfur dioxide, soot and others that cause severe health problems in people than new power plants of any kind.

Needed Infrastructure

The LB 1115 study of transmission line capacity in Nebraska concluded that, with completion of the high voltage Neligh-Hoskins and R-Project transmission lines, Nebraska would be able to add at least another 2,000 MW of wind farms above what was built or planned at the time[xx]. Our Husker Energy Plan anticipates the addition of 1,500 to 1,850 MW of new wind capacity to serve Nebraska.

The Neligh-Hoskins transmission line in northeast Nebraska has been completed, but the R Project is awaiting permits and has not been built. Since the completion of the Brattle report in December, 2014, there have been substantial changes in the Nebraska power industry. The Fort Calhoun nuclear station has been retired, and Omaha Public Power District announced plans to reduce the capacity of its North Omaha power-plant and transition the facility from coal to natural gas. Some of the anticipated new wind farms have been built, and utilities have announced plans to bring on additional wind and solar generation. In 2014, the Southwest Power Pool launched its Integrated Marketplace, which provides for regional dispatching of the power needed for and generated by Nebraska electric utilities. Distributed energy strategies that provide generation and energy storage closer to the load centers where electricity is used are developing rapidly.

Given the changing landscape, we believe ongoing studies by Nebraska utilities and the Southwest Power Pool will continue to be required to assess the needs for transmission line upgrades, new construction or other changes needed to meet Nebraska's electricity needs and add new wind.

As utilities move forward with new demand management and Smart Grid initiatives, and begin to close outdated coal-fired power plants, additional capacity would be freed up on existing transmission lines. We assume that utility scale solar projects would be built closer to the load they serve, reducing the need for long distance transmission.

As Nebraska and other states have increased their use of renewable energy, the Southwest Power Pool (which schedules and dispatches generation resources to match the demand) has responded with strategies to better integrate and plan for renewable resources. The Southwest Power Pool (SPP) has expanded to add utilities in North and South Dakota, expanding the diversity and reach of resources integrated into the SPP system, and the Colorado Public Utilities Commission is considering joining the SPP. Proposed new Federal Energy Regulatory Commission rules could add value to resources that are fast-start and can react quickly to needs on the grid. That could increase the value of instant-reaction resources like batteries, and could increase the value of fast-start resources like compressed air or natural gas turbines over coal-fired or gas fired boilers, which typically take hours to come online.

Southwest Power Pool studies say at some point there is likely a need to increase the capacity of the 7 DC ties that connect the Western Grid with the power grid in the central US. Those ties currently only have 1,310 MW of capacity. The Laramie River Station in Wyoming, which provides electricity to Lincoln Electric System and Tri-State G&T, has one unit that supplies power to the Eastern Interconnection and two units that supply power to the Western Interconnection. We do not believe our Husker Energy Plan would substantially change the situation with respect to those DC ties, as our plan doesn't rely on out-of-state power imports or large exports of Nebraska power to other states.

Transition Impacts

Several of Nebraska's coal-fired power-plants operate in relatively smaller communities (including Sutherland, Nebraska City, and Hallam). In the future, retiring these power plants would impact local jobs, payments in lieu of taxes to local governments, and economic activity. We believe these communities and the utility employees deserve both lead time and assistance to make the transition as beneficial as possible.

By starting now, rather than waiting until closure is imminent, employees and communities would have a longer and a much smoother transition, with opportunities for employees for early retirement, transition to other jobs at the utility, re-training for jobs in the growing renewable energy sector, and transition to jobs in other employment sectors.

Communities would have opportunities to develop new wind and solar projects, create jobs through energy efficiency initiatives, and implement other plans to replace jobs potentially lost.

For example, in the case of Sutherland, portions of southwest Nebraska have a combination of high wind and low wildlife impact, and the immediate Sutherland area has high solar energy potential and good transmission line access. As capacity is freed up on the large transmission lines from the closure of outdated coal-fired power plants, new wind and solar farms could provide short-term and long-term jobs in that area as well as other Nebraska rural communities.

We recognize that Nebraska utilities now make payments to local governments in lieu of property tax payments, and under our Husker Energy Plan those payments would increase or decrease depending on the area. Putting in place a timeline for building new wind and solar farms and closing outdated coal power plants would allow for a transition for communities, and could involve specific phase-down in lieu of payment agreements between utilities and communities.

We also recognize that we cannot leave Nebraskans behind as we move to a clean energy future. Fortunately, this Husker Energy Plan should cost no more overall than a ‘business as usual scenario’, which should keep electric rates affordable while delivering new jobs and investment across the state. In addition, community-driven energy efficiency programs should find the most fertile areas for energy savings in older and lower-income neighborhoods, helping reduce energy bills in those areas. Nebraska needs a careful strategy that will meet the energy needs of Nebraska’s most vulnerable populations, so all Nebraskans will benefit from the cleaner energy, and cleaner air, that results.

Nebraska’s Clean Energy Future

Nebraska boasts a variety of affordable, readily available clean energy options that can transform our electric utility system, provide new jobs and investment, and power Nebraska’s economy into a clean energy future. Since Nebraska is a 100 percent public power state, the benefits of a well-planned transition to clean energy will accrue to all the residents of Nebraska.

As we have outlined in this Husker Energy Plan, with the right mix of energy efficiency, peak demand management, wind, solar, energy storage and other clean energy options, Nebraska can transition away from dirty fossil fuels like coal, providing enormous health benefits to our residents. We can lock in a clean energy future with electricity that is affordable, prices that are predictable, and energy produced largely within our borders. We can save Nebraska businesses and residents hundreds of millions of dollars every year in energy costs[xxi], and the environmental and health benefits would be even larger than the economic benefits.

With our Husker Energy Plan, we can give ourselves a clean energy future, and leave our children and their children a more efficient and effective economy and a better world.

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[i] Nebraska produces no coal, and produced 17.7 trillion Btu's of crude oil in 2015, less than 9% of the 202 trillion Btu's of fuel consumed by Nebraska's transportation sector, measured on a Btu basis. Nebraska produced 477 million cubic feet of natural gas in 2015, about 0.3% of the 162 billion cubic feet of natural gas consumed in Nebraska that year. Our natural gas production has been declining.

[ii] Nebraska Energy Office, Coal Expenditures by Sector, Nebraska, 1990-2014, at neo.ne.gov/statshtml/63.html.

[iii] Many studies document the health impacts of pollution from coal-fired power plants, including National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*, National Academies Press, 2010.

[iv] Nebraska Department of Health and Human Services, as of June, 2016.

[v] Wilhite, Dr. Don et al, *Climate Change Implications for Nebraska*, University of Nebraska Lincoln, September, 2014.

[vi] U.S. Department of Energy, Energy Information Administration, *Table C13. Energy Consumption Estimates Per Capita by End-Use Sector, Ranked by State, 2015*, State Profile and Energy Estimates.

[vii] John "Skip" Laitner*, The Energy Efficiency Benefits and the Economic Imperative of ICT-Enabled Systems*, Springer.com, 2015.

[viii] American Council for an Energy Efficiency Economy, *How Much Does Energy Efficiency Cost?* 2016 Fact Sheet, www.aceee.org.

[Vii] OPower, for example, reports that behavioral demand response programs are saving utilities 3% to 5% off peak demand, claims that have been verified by independent studies.

[x] The Nebraska Power Association 2017 Load and Capability Report projects a 0.4% future average annual growth in capacity needed to meet Nebraska's peak electricity needs. The report does not provide a future projection for growth in total electricity consumed.

[xi] Nadel, Steven, *Demand Response Programs Can Reduce Utilities' Peak Demand an Average of 10%, Complementing Savings From Energy Efficiency Programs*, American Council for an Energy Efficient Economy, February, 2017, http://aceee.org/blog/2017/02/demand-response-programs-can-reduce

[xii] Epley, Cole, *NextEra's Wind Energy Capacity in Nebraska Will More Than Triple With New Projects*, Omaha World Herald, June 15,2017.

[xiii] Nebraska Energy Office, *Solar Energy Generation in Nebraska*, www.neo.ne.gov/statshtml/198.htm

[xiv] Hill, Joshua, *US Wind Industry Highlights 66% Drop in Costs of Wind Generated Electricity*, June 16, 2016, cleantechnica.com/2016/06/16/us-wind-industry-highlights-66-drop-costs-wind-generated-electricity/

[xv] Timmer, John, *Solar Energy Has Plunged in Price, Where Does it Go From Here?* arstechnica.com/science/2017/04/whats-next-for-solar-energy/

[xvi] A capacity factor of 45% means that over a year a 100 MW wind farm would generate 45% as much wind energy as the wind farm could generate operating at maximum capacity during the year.

[xvii] Currently 1,320 MW of wind generation is in place in Nebraska, 7 MW are under construction, and 200 MW of wind in Oklahoma and Kansas serve Nebraska (Lincoln Electric System). Nicholas Bergan, *Turbines Propel Nebraska Past a Wind-Energy Milestone*, Lincoln Journal Star, May 3, 2017, reports another 586 MW of wind energy is in various stages of development.

[xviii] The proposed 5.8 MW solar facility is projected to cost $11 million, or about $1.90 per watt.

[xix] Cusick, Daniel, *Battery Storage Poised to Expand Rapidly*, Scientific American, January 1, 2017.

[xx] The Brattle Group, *Nebraska Renewable Energy Exports: Challenges and Opportunities (LB 1115 Study),* December 2014.

[xxi] Savings is based on both the savings that Nebraska consumers would see on their electric bills from using energy efficiency programs, and additional savings that would accrue on their natural gas (or propane) bills from the weatherization investments made through those programs.