Opportunity on the Line:
Transmission infrastructure remains largest obstacle
to meaningful expansion of renewable energy
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The electric power transmission network was not designed to penetrate lightly populated regions of the Upper Midwest and Great Plains, a region brimming with wind energy potential. Instead, our grid was designed to connect large, individual generating units with discreet population centers. It is abundantly clear that those states with the greatest wind resources – and therefore the greatest development potential – are leaving a lot on the table when it comes to economic development and energy independence within their respective states.

An examination of the transmission infrastructure now in place throughout the 10 states rated by the National Renewable Energy Laboratory as having the highest potential for wind development emphasizes this point. Lines of 400 kV or larger are needed in greater numbers if we are to commit to integrating significant amounts of wind power into our energy portfolio. Of the 37,736 miles of lines greater than 400 kV, only 2,348 – 6 percent - are located in the top 10 states for wind energy potential. Astonishingly, of the 3,710 miles of lines capable of carrying capacity greater than 600 kV, only nine miles are located in states that lead the nation in capacity potential. That’s good for less than 1 percent.

While myriad solutions have been considered, two in particular present themselves as logical answers to one of rural America’s most pressing problems. More efficient use of infrastructure now in place is a critical first step, a goal made especially important as coal-fired power plants throughout the region continue to close. Commitment to an improved, expanded grid must come next. It is imperative that utilities come to terms with the situation at hand and begin to address the most obvious of the capacity shortfalls now stymieing development.

The past two decades have witnessed a number of important reforms which collectively promise to change the way we plan the expansion of our electric grid and ensure access to the renewable resources we must depend on to meet current and future energy needs. Ambitious expansion projects are now underway. However, any effort to better utilize our abundant wind resources will require us to go above and beyond what is now in place and make a commitment to rural economic opportunity both now and in the future.
A lack of transmission infrastructure remains the biggest impediment to a meaningful expansion of the wind industry. Design of the electric grid exacerbates the problem. Modeled to serve areas of high population, the majority of transmission lines already in place are located far from the Great Plains region, home to the greatest wind resources in the continental United States.

This paper attempts to better illustrate the predicament faced by renewable energy supporters, wind energy developers, and the numerous utilities interested in affordable, low-cost generation options. We begin by taking a closer look at the development of our electric industry, the considerations that shaped the earliest electric grid, and the policy changes that led to a new perspective in infrastructure planning. We then compare the areas with the greatest wind potential with those that boast the greatest transmission resources, showing a sharp disconnect and ample potential for improvement.

By analyzing data that demonstrates where and why transmission lines have historically been located, we can better understand the challenges we face and the progress that must be made. Finally, this paper will discuss options for moving forward, showing that a balanced approach between building new lines and making better use of those already in place is needed if we are to utilize our abundant renewable resources in a cost-effective and efficient manner.
An Industry in Flux

The electricity industry has changed dramatically since the late 19th century. For many years, the dominant electricity provider had been the local public utility. In most cases, the local utility was an IOU – investor owned utility. In other cases state, local, or federally owned public utilities assumed this role. Each utility was in charge of their own transmission system, which was built exclusively to connect a central generating unit with the population center that unit served.

Developing the Electric Grid

Regardless of their makeup, the electric utility has historically thrived through vertical integration by generating, transmitting, and distributing electricity to the end users in their territory. The technology available at the time allowed centralized stations to deliver power directly to population centers, provided that there were enough transmission lines in place to do so. Each utility proceeded to connect multiple plants, lowering electricity costs and keeping pace with the population growth many of our metropolitan areas were experiencing.

Economies of scale and technological innovation enabled producers to transport electricity over longer distances, serving larger markets, effectively growing in tandem with the urban population. Utilities further consolidated, relying heavily on coal-fired power plants to serve tremendous increases in demand. From 1935 to 1965, demand doubled every 10 years.1 Transmission lines proliferated, but were located almost exclusively in population centers served by the relevant utility.

This began to change with the Public Utility Regulatory Policies Act of 1978 (PURPA). Passed as part of the National Energy Act, PURPA created competition in the marketplace by encouraging independent power production through co-generation and small-scale power generation (80 megawatts or less).2 By creating alternatives to large public utilities, new and cheaper generation sources were introduced, the majority of which tapped into renewable resources to create electricity.

Local public utilities were required to buy the excess power generated by these smaller scale sources at the same price it cost the utility to generate electricity. Since the cost of producing power was often lower for cogenerators and owners of small systems, they had an incentive to produce as much as possible, knowing the local utility was guaranteed to purchase whatever amount they produced.

Because this power cost less to produce, it soon became the preferred option for consumers. Residences, commercial facilities, and industrial consumers of electricity all wanted access to cheaper electricity. The old model that had taken shape during the middle of the 20th century, relying on a single utility to both produce and distribute electricity, became less attractive. For the first time reliance on a central generating unit was no longer the best way to serve customers. Instead, diverse resources were needed to meet customer needs and keep rates low.

Transmission, once the solution, now became the problem. While smaller power producers were able to sell their power to the local public utility, they were not allowed to use that utility’s transmission lines to move their power anywhere else. Transmission lines were privately owned. Even if they could use these lines, they were almost exclusively located near large population centers, far away from the renewable resources that powered most of the smaller systems. In order to meet the growing demand for lower priced electricity, the smaller producers would need to find a way to get that power from where it’s produced to where it’s needed. It was clear that the electric grid, along with the industry that powered it, needed to change.

A Different Approach

In many ways America’s ability to ensure low-cost electricity depends on a free market. A free market, in this context, depends on open access to transmission. Recognizing this, Congress in 1992 passed the Energy Policy Act (EPAct), establishing a set of guidelines that have played a strong role in shaping the electricity industry we see today.3

EPAct led to the development of a more competitive and less regulated wholesale market, one that opened the door to more independent power producers and set the stage for the proliferation of renewable energy systems. Much of this was achieved by authorizing the Federal Energy Regulatory Commission (FERC) to order those utilities that own transmission facilities to allow access for wholesale power producers. In effect, these lines can no longer be used exclusively by the owning utility, but by anyone who needs them. By doing so, generation access is open to more customers, and U.S. electricity consumers save between $3.8 billion and $5.4 billion in electricity costs per year.4

Today, the transmission system is managed not by individual utilities, but by Regional Transmission Organizations (RTO) who remain neutral in allowing equal access to wholesale power generators. Each RTO administers the region’s wholesale electricity markets, remains independent from market participants, and has the authority to plan and expand the regional grid. Existing and potential transmission users have the same access to transmission information the transmission owner enjoys. Anti-competitive behavior is disallowed, and each state experiences...
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a measure of retail competition within its boundaries as new power marketers and independent generators enter the fray.

As a result of these changes, population growth is no longer the sole determining factor in the decision to expand the transmission system. While allowing independent power producers access to transmission lines was an important hurdle to cross in the quest for clean and low-cost energy, the problem of geography remains. Because transmission lines were located near demand centers for so many years, it’s important that we now concentrate on expanding the grid to tap our renewable resources, the same affordable resources that inspired the move toward an open access approach.

To that end, in 2010 FERC released Order 1000. This landmark decision emphasizes a regional approach to transmission planning, involving diverse stakeholders from across the spectrum, including those with environmental or consumer interests. Significantly, this rule requires that planning processes must consider the impacts of existing public policies such as state renewable energy portfolio standards, state and federal efficiency mandates, and EPA clean air rules when deciding which lines to build and where to build them. Finally, Order 1000 fairly spreads cost to those who benefit from the new lines.\(^5\)

In taking an interconnection-wide view, this regulation not only encourages a transmission build-out, but one that is done in the right way. Planners are now forced to consider alternatives to transmission and the very serious impacts that an infrastructure expansion can have on a region – both positive and negative. These changes are widely expected to catalyze one of the largest transformations of the electricity industry ever seen. This will be achieved by bringing clean, affordable, and reliable energy to market while encouraging grid expansion in a way that allows us to tap many of our most abundant renewable resources.
Through it all, it’s clear that the electric power transmission network we have developed was not designed to penetrate lightly populated regions of the Upper Midwest and Great Plains, a region brimming with wind energy potential. Instead, we have seen that our grid was designed to connect large, individual generating units with discreet population centers. The past two decades have witnessed a number of important reforms which collectively promise to change the way we plan the expansion of our electric grid and ensure access to the renewable resources we must depend on to meet current and future energy needs.

We are well on our way to modernizing what has been termed “America’s greatest engineering feat,” preparing to meet future needs while simultaneously acknowledging the lessons we have learned along the way. Are we there yet? We are not even close. But most agree we are heading in the right direction.

Wind Resources

The benefits of wind energy are well known. What is less well known is exactly how far we need to go in order to reap these benefits. Transmission limitations have been identified as the biggest remaining obstacle to an expansion of our wind energy industry and a significant barrier to rural economic development. Almost 300,000 MW of wind energy projects, in various stages of development, are simply waiting for an opportunity to connect to the grid.

Before we become a country that can take advantage of renewable resources to meet our energy needs, it is imperative that we build an electric grid that allows us to tap these distant resources, often located in rural areas far from population centers and consequently far from the historic reaches of the electric grid. A comparison of those states with the highest wind energy potential to those with the most miles of transmission lines already in place will illustrate just how much work is ahead of us.

Unsurprisingly, the states with the greatest wind resource potential reside in the Great Plains region. Texas is the undisputed leader, with the potential to generate 6,527,850 GWh annually. Kansas is second, followed by Nebraska, South Dakota, Montana, North Dakota, Iowa, Wyoming, and Oklahoma. Minnesota rounds out the top 10 with the ability to generate 1,679,480 GWh of wind energy annually.

When it comes to installed capacity, most would expect the 10 states listed above to lead the pack. They do not. Of those 10, only Texas and Iowa have a place among the top 5 states that boast the greatest installed wind capacity. The rest of the top 10 is instead populated by an unlikely group. Oregon, which has the 23rd best wind resource potential, makes the top 10. Washington, at 24th, makes the cut too. It is abundantly clear that those states with the greatest wind resources – and therefore the greatest development potential – are leaving a lot on the table when it comes to economic development and energy independence within their respective states.
Transmission Lines & Wind Resources

What is behind this epidemic of missed opportunity? Much of this is influenced by population. Despite the ability of many utilities to export wind energy to population centers outside state boundaries, whether to meet clean energy demand or to satisfy renewable portfolio standards, the fact is that greater population leads to greater demand. Understandably, the utilities in most states are concerned with serving their own population first and foremost, often putting export plans on the back burner until a demand for their product is safely established. More acutely, population leads not only to greater energy demand, but also to a greater need to build transmission infrastructure capable of meeting that demand.

Transmission lines are assessed first by their capacity. This capacity is measured by voltage, expressed in kilovolts, and is an indicator of the amount of energy each line is capable of moving. Common measurements are 345 kV, 500 kV, and 765 kV. A larger number indicates a larger capacity, and a greater ability to not only serve areas demanding more energy, but to move larger amounts of energy from where it is produced to where it’s used. The distance each line covers is measured in pole miles, a measurement equivalent to one mile of overhead line structures. This is a measurement of distance only and is not influenced by the capacity of the line in question. To ensure the most abundant wind resources are tapped, and this energy is moved to where it is needed, each state that boasts high wind potential needs not only high capacity lines, typically greater than 500 kV, but also sufficient pole miles of these lines.

Using data provided by the Federal Energy Regulatory Commission (FERC), Edison Electric Institute tracks the number of transmission lines throughout the United States and offers statistics relating to the capacity of each line and the pole miles that an individual line covers. Instead of classifying capacity using the standard measurements cited above, FERC classifies lines based on a capacity range: 254-400 kV, 401-600 kV, and 601 kV and greater. Their data confirms that much of the Great Plains region lags far behind other states when it comes to both the capacity and length of transmission lines in place. In order to transport this energy from where it is produced to where it’s needed most, this region should feature a high propensity of lines of 401 kV and above.

Texas, which holds not only the greatest wind energy potential in the United States but also leads the nation in terms of installed capacity, is also a national leader when it comes to transmission. This state alone is home to 10,623 pole miles of line in the 254-400 kV range, a number higher than all of New England, the Mid-Atlantic region, the South Atlantic region, the East-South Central United States and the Pacific Northwest combined; this is good for first in the nation. However, much of this is attributed to the large geographic area this state covers, the sparse population that must be served in many of the less developed parts of the state, and the fact that Texas is the only state that is part of the ERCOT interconnection.

The statistics become far less impressive once one looks at lines greater than 400 kV. Here, Texas is 31st, a direct result of lower population density and an electric grid built primarily to serve high-population areas. Despite their development of a successful wind industry, the state has no lines above 600 kV. If this state is to further develop their wind industry, which they’re certainly capable of doing, it is critical that a commitment is made to higher capacity lines designed to tap these vast wind resources.

Minnesota is assisted by an important transmission line connecting to Canada, responsible for a significant portion of the 806 pole miles of lines greater than 400 kV. Their position as an important conduit for low cost coal generated electricity from the Dakotas into the demand centers within Midwest Indepen-
dent System Operator also plays an important role, leading to almost 3,000 miles of lines in the 254 to 400 kV range. However, the vast majority of this development has taken place far away from the southwestern part of the state, the region which does most to qualify Minnesota as a top 10 state for wind resources. As the transmission grid within this region expands, evidenced by the large scale CapX2020 project and others in various stages of development, it is clear there is a concerted effort to tap this region in order to utilize its potential.

The remaining states that rank highest in wind energy potential do not fare as well. As expected, this is largely a function of population. Iowa, like Texas, does better than most every other state when it comes to utilizing their tremendous wind energy potential. In a state void of significant deposits of fossil fuels, Iowa has officially turned itself into an energy state, along the lines of Wyoming, North Dakota, and West Virginia, solely by taking advantage of their strong renewable resources. They have accomplished this despite having only the 18th most miles of transmission lines at a capacity between 254 and 400 kV, and only one mile of lines greater than 400 kV. Again like Texas, Iowa is home to some of the largest transmission bottlenecks in the nation. Though there are currently plans to expand the grid in Iowa, including the Rock Island transmission project, it is clear that much more is necessary.

North Dakota, despite being home to significant coal resources and a number of coal-fired power plants, ranks only 19th when it comes to lines between 254 and 400 kV. The state is also without any infrastructure greater than 600 kV, a key measurement for a state leading the nation in wind power potential. South Dakota ranks fourth in wind energy potential but falls a distant 25th in capacity between

**Source:** American Electric Power, American Wind Energy Association, Center for American Progress, Department of Energy, Edison Electric Institute, Energy Information Administration, Electric Power Research Institute, Federal Energy Regulatory Commission, National Renewable Energy Laboratory, U.S. Environmental Protection Agency, Western Resource Advocates

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254 and 400 kV at only 473 miles. The state has only two pole miles of lines greater than 400 kV.

Kansas, ranking third in potential, has the 15th most miles of transmission lines between 254 and 400 kV. That state has, however, only seven pole miles of lines greater than 401 kV. Nebraska ranks sixth in wind potential by some measurements, and up to third in others, but features only 1,511 miles of lines between 250 and 400 kV, good for 17th, and only two miles of lines greater than 400 kV.

Due to discrete pockets of population, each of these 10 states feature enough lines of 254 kV and above to serve their population and to ensure reliable electric service. But each lacks a transmission system that includes high capacity lines capable of tapping the tremendous wind resources of the region. This is where capacity matters. Lines of 400 kV or larger are needed in greater numbers if we are to commit to integrating significant amounts of wind power into our energy portfolio. Of the 37,736 miles of lines greater than 400 kV, only 2,348 — 6 percent - are located in the top 10 states for wind energy potential. Astonishingly, of the 3,710 miles of lines capable of carrying capacity greater than 600 kV, only nine miles are located in states that lead the nation in capacity potential. That’s good for less than 1 percent.
Next Steps

It is clear that a commitment to improving our transmission infrastructure is long overdue, and absolutely essential as we move toward a clean energy economy. There is no single greater barrier. But how can we achieve this? While there are a number of options available, two in particular present themselves as most effective. In the first place, we will need a substantial commitment to building a network of newer and larger transmission lines throughout the Great Plains region. In the second, we have to become smarter about the way we use the transmission we have in place today.

Grid Expansion

In addition to opening new areas to wind development, transmission lines also serve the important function of reliably integrating wind energy into the bulk power system. If wind is to be relied upon as a steady source of low-cost energy, a robust grid is needed in order to connect resources over a diverse geographic area to the population centers that demand energy. In many instances expanded infrastructure can actually reduce the rates customers pay for their power by ensuring more low cost energy enters the market.

Transmission lines are also critical to maintaining reliability of our electric system. The Department of Energy estimates that up to 70 percent of our transmission lines and transformers are at least 25 years old. It’s been estimated that the United States is spending $11 billion a year less than it should on electric infrastructure improvements, leading to a $107 billion electricity investment shortfall by 2020. This is partially due to the fact that simply maintaining the lines already in place will alone cost up to $10 billion each year. That same report shows that power outages will cost American businesses and households almost $200 billion by 2020.

No matter the reason, new lines are needed. Recognizing this, the Midwest Independent System Operator (MISO) announced an ambitious plan to expand the electric grid throughout the Upper Midwest. Referred to as the Multi Value Project (MVP) portfolio, MISO identified 17 potential projects within their footprint that will provide benefits in excess of total costs. As a whole, this portfolio will maintain system reliability by resolving a number of reliability violations, enable 41 million MWh of wind energy per year to meet renewable energy mandates and goals, and support a variety of generation policies by using a set of energy zones which support wind, natural gas, and other fuel sources. By focusing on projects that provide multiple economic, reliability, and public policy benefits, MISO took a critical step toward meeting present needs while preparing for the future.

As of 2012, each of the 17 proposed MVP projects have been approved and are in various stages of development. The MVP portfolio demonstrates that, despite decades of slow growth, transmission investment has picked up since 2010. In 2005 only $7.5 billion worth of construction took place; by 2010 that number had grown to $10.2 billion.

While large regional projects certainly play a role here, utilities and other developers have begun thinking outside the box to ensure there is enough transmission in place to meet our needs. For example, Clean Line’s Rock Island transmission project will use HVDC technology to move energy from western Iowa to the Chicago area. This technology carries a higher price tag but promises long-term benefits that justify the initial cost. These trends are expected to continue as transmission spending increases by 43 percent over the next three years. In total, $169.7 billion worth of transmission projects will be completed between 2012 and 2020.

Projections, however, do not tell the whole story. The Federal Energy Regulatory Commission shows that only 98.6 miles of transmission projects were completed between January and April of 2012, despite brighter predictions. Such a low number falls far short of the pace necessary to keep up with the 1,985 miles completed during 2011. This shows that more is needed than adequate finances. For better or worse, the regulatory hurdles each utility must cross before finally beginning construction often derail needed projects. Up to 10 federal agencies can get involved, in addition to the myriad state permits needed each time construction is proposed or a rate increase is needed. Wildlife, aesthetic, environmental and transportation concerns are often enough to stop a project in its tracks.

Community opposition can also stall projects that have been permitted, adding an additional challenge to the expansion of our electric grid. It’s common for more than 10 years to pass between proposal and completion, forcing each utility to plan far into the future.

Recognizing this, there have been positive changes made from a regulatory standpoint that both minimize some of the many hurdles while also incentivizing informed expansion. The Energy Policy Act of 2005, state renewable portfolio standards, federal programs promoting grid development under the American Recovery and Reinvestment Act (ARRA), and a host of FERC incentives have all made positive impacts. Order No. 1000, in particular, introduced reforms designed to improve regional and interregional planning procedures, recognizing that renewables
must be considered in the transmission planning process and establishing an approach to cost allocation that places value on a project’s ability to help satisfy state renewable portfolio standards.\textsuperscript{18}

In addition to regulatory reform there has also been a concentrated effort on the part of utilities, non-profit organizations and, in some cases, state and local government to ensure that the input of landowners and community members impacted by proposed lines is considered throughout the planning process. In 2010 the Eastern Interconnect Planning Collaborative received funding from the U.S. Department of Energy to prepare analyses of transmission requirements under a broad range of alternative futures and develop long-term expansion. This allowed consumer, environmental, rural and landowner organizations to weigh in on future transmission plans.

Also funded by the U.S. Department of Energy, the Heartland Alliance for Regional Transmission (HART) focuses on engaging average citizens in the transmission planning process. By connecting local decision-makers such as farmers and ranchers, county commissioners, and local chambers of commerce with more traditional stakeholders, those most impacted by transmission projects are given a seat at the table. This gives local residents a chance to learn about each project and provides them with the tools they need to effectively share their perspective and weigh in on the planning process.

**Creative Capacity**

Considering the challenges faced when planning for transmission expansion, many utilities are recognizing that making efficient use of lines already in place can help save both time and money. The continuing closure of coal plants presents an ideal opportunity for utilities located in wind-rich regions. In many cases a plant slated for closure will free needed transmission capacity, allowing the implicated utility to think broadly about how best to utilize infrastructure already in place. A movement away from a fossil fuel intensive energy portfolio is capable of providing needed opportunity while saving some of the time and money that goes into an expansion of the grid.

It is estimated that both market conditions and recent and impending environmental regulations will result in 59-77 MW of coal retirements by 2016.\textsuperscript{19} Up to 353 coal-fired power generators in more than 30 states are no longer economically viable. This represents approximately 18 percent of the nation’s coal capacity and approximately 6 percent of all electricity generated. The average plant expected to retire is 45 years in age and on average operate at 47 percent of their power generation capacity.\textsuperscript{20} These planned retirements ensure that the share of coal generation as part of the nation’s electricity portfolio will continue to trend downward. According to the Energy Information Administration, coal’s share of total net generation dropped to

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\textsuperscript{18} Opportunity on the Line | Center for Rural Affairs 11

\textsuperscript{19} Multi Value Project Portfolio Results and Analyses, Midwest Independent System Operator (2012)

\textsuperscript{20} MISO - using Ventryx, Velocity Suite © 2011
While many utilities have identified vulnerable coal-fired power plants that have long ceased to operate efficiently, others are faced with a series of difficult decisions when it comes to generators that are on the precipice of profitability. One such utility is the Nebraska Public Power District, owners of Gerald Gentleman Station (GGS) near Sutherland, Nebraska. GGS features two separate units, capable of generating 1,365 MW of power. Each unit is more than 30 years old and in 2010 ran at a 78 percent capacity factor. The utility is currently considering whether to invest over $1.5 billion in this plant in order to bring it into compliance with a host of upcoming Clean Air Act regulations.

The decision faced by NPPD is difficult not only because of the significant cost required to comply with rules that protect the health and environment of Nebraska, but also because of current trends in the energy industry. The cost of coal continues to rise, as do the transportation costs necessary to move coal to the end user and the costs associated with disposal of coal ash. The negative health and environmental impacts of coal-fired power plants are more widely understood now than ever before, a reality reflected in the long-awaited enforcement of Clean Air Act rules designed to hold utilities accountable for the myriad negative externalities resulting from their use of fossil fuels. All of this is taking place against a backdrop of increasingly competitive prices for wind power and a dramatic need for economic development in the rural areas surrounding this unit.

Gerald Gentleman Station is located in wind-rich western Nebraska, within the Southwest Power Pool (SPP) footprint and along a series of transmission lines flowing eastward toward the demand centers of Lincoln and Omaha. The western portion of SPP is home to most of this region’s greatest wind resources. Because of the low population density of this area there is little in the way of transmission lines necessary to move energy from where it’s produced to where it is needed. Transmission constraints in the western portion of the SPP footprint are the single greatest barrier to wind development. Any significant increase in this region’s wind generation portfolio will need to flow eastward, and will need a corresponding expansion of the electric grid.

The overall capacity factor (a measure of how often each turbine produces power) of wind plants in this region hovers consistently around 39 percent. The key to effectively utilizing this relative-

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**Ripe-for-Retirement Generators Located in 31 States**
(High Estimate by Size of Generators: 353 Generators Totaling 59 GW*)

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As many as 353 coal generators in 31 states are ripe for retirement (red dots) according to our high estimate, which compares the cost of operating coal-fired generating units with the cost of operating existing NGCC generating plants. These 353 units total 59 GW of capacity, about 6.3 percent of electricity generated nationwide.

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*Includes all utility-scale generating units using coal as a primary fuel source, except those that have already been announced for retirement. Each dot represents an individual generator (some dots represent multiple generators at the same power plant); the size of the dot depicts its generating capacity. Capacity is the amount of power a generator is capable of producing when operating at full (100%) output, typically measured in megawatts or gigawatts (1 gigawatt = 1,000 megawatts). A gigawatt of coal generating capacity is capable of producing enough electricity to power approximately 1 million typical U.S. homes.
ly high capacity factor lies in geographic diversity, as mentioned previously. Because the wind is always blowing somewhere, geographic diversity mitigates the variability of aggregate wind generation throughout the region.

For the SPP to take advantage of its abundant wind resources, it must also take advantage of the predominant weather patterns of the area which consistently flow from northwest to southeast. It is known that the average weather pattern takes approximately 10 hours to reach southeast Oklahoma from northwest Nebraska, spanning the majority of the SPP area. Because the majority of wind installments within SPP’s territory are in the southern portion, and because there is very little in the way of transmission resources in the northern half, any efficient utilization of the tremendous wind potential available requires targeted transmission upgrades to enable the delivery of wind power.

Very real concerns regarding reserve capacity and reliability are at play whenever a utility decides to make a change to their energy portfolio. While these technical considerations are beyond the scope of this paper, a look into the decision facing NPPD and the current state of wind development within the SPP indicates that an open-minded approach is required when deciding whether to upgrade Gerald Gentleman Station in order to comply with impending environmental regulations. The transmission capacity already in place suggests that upgrading just one of the two units at GGS might be the best solution for the utility and the state.

Because GGS is located in a wind rich region devoid of renewable energy development, there is a real opportunity to better serve customers within NPPD’s service territory with cleaner, more cost-effective resources, opposed to continually relying on coal as the dominant fuel. Nebraska is a public power state that gives local residents a say in this decision process, and it’s likely these residents would welcome the nearly $11,000 increase in county-level personal income and the one job for every two MW of installed wind capacity provides.
Conclusion

Clean energy transmission plays an important role in providing opportunity for rural economic development while securing a clean energy future. Tapping the vast renewable resources at our disposal requires a commitment to building high capacity transmission infrastructure in regions rich in wind potential. Less than 1 percent of transmission lines capable of transporting significant amounts of wind energy, those 600 kV and above, are located in the 10 states with the highest wind energy potential.

While it is understood that our electric grid was built to accommodate high population density, future expansion of the grid must consider integration of renewable resources if we are to meet our energy needs using clean, safe, and cost effective resources. Though regulatory policy has slowly evolved to recognize this need, it’s imperative that utilities and grid operators consider the geographic distribution of renewable resources in any future planning exercise. Better placement of transmission lines, more efficient use of current infrastructure, and an acknowledgement that both transmission and wind resources are important pieces of our energy future are all required. With improved planning we can create an improved quality of life and build the strong rural communities we need to create a sustainable future moving forward.

Notes

4. Tomain, supra.
18. See id. § 35.

* Photos on page 1 and 2 by Wyatt Fraas