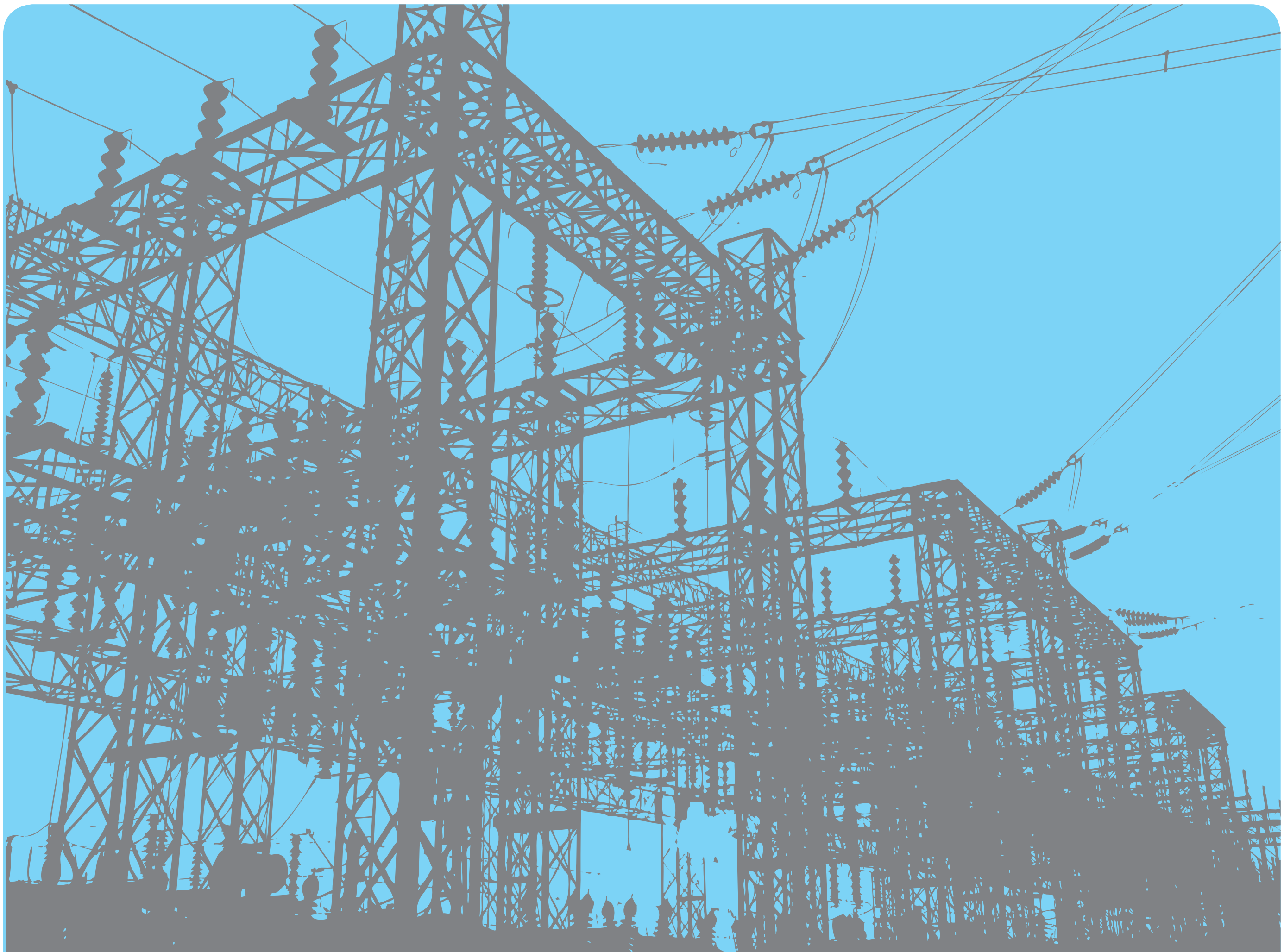
Connect the Dots:
Transmission and Rural Communities



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Connect the Dots:
Transmission and Rural Communities

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Executive Summary

A robust electric grid is vital to the health of any economy. Successful improvement of the decades-old infrastructure already in place will enhance reliability, allow for the seamless integration of renewable resources and account for heightened electricity demand.

This effort will open the door to new economic opportunities. Developing new transmission infrastructure will enable renewable energy projects that were otherwise too remote to be of significance. Because renewable resource development is most practical and cost effective in rural areas, these communities will realize the most potential.

This report examines the economic impact an expanded electric grid will have on the many rural regions that are rich in renewable resources. The following points highlight the need for an expanded transmission system while bringing attention to the foremost benefits that will result:

- The majority of transmission lines were constructed 30-50 years ago. Approximately 60 percent of circuit breakers and 70 percent of transformers are now over 25 years old.
- Over 275,000 MW of new wind projects remain unconnected due to a lack of available transmission.
- Power from conventional coal sources cost $68 per megawatt-hour, while power generated from wind projects built in high-resource areas cost $65 per megawatt-hour.
- With adequate transmission, up to 40 percent of electricity demand can be met by wind without adversely impacting grid reliability.
- Every $1 billion of U.S. transmission investment supports approximately 13,000 full-time equivalent years of employment.
- Annual wages associated with transmission construction average $65,300, compared to $33,760 across all industries.
- At least 100,000 MW of additional wind generation is needed to satisfy existing state Renewable Portfolio Standards. An additional 90,000 MW would be needed to meet a 20 percent federal Renewable Portfolio Standard. Approximately $210 billion to $400 billion will be needed in order to install the wind capacity necessary to meet these standards, creating 2.6 million to 5 million full-time equivalent years of employment.
- In the past 4 years, jobs in the renewable energy sector grew nearly 8 times the amount of jobs associated with conventional energy.

After years of underdevelopment the United States is now in position to improve upon a decades-old transmission network. The lack of grid development to date has hampered the development of many renewable energy projects as we have repeatedly forgone economic advancement in favor of the status quo. Opening the door to a new generation of renewable energy projects will bring opportunity to rural communities across the nation. A comprehensive effort to improve existing lines while strategically placing others is a critical step forward in the growth of a changing economy.

Introduction

Demand for renewable energy has increased substantially during the past decade. A shift in consumer preferences, growing cost considerations, pointed environmental concerns and potential for economic opportunity are all indicative of continuing demand for a cleaner, more stable source of power. This new-found dependence will give rise to a new challenge and a new source of opportunity, bringing change to rural regions located in areas rich in renewable resources.

This report explores the challenge and opportunity associated with an evolving energy industry, focusing on the benefits expected to accrue to rural communities. It begins by highlighting the factors which drive the need for improved transmission infrastructure. The spotlight then shifts to opportunity by bringing attention to the economic potential to be realized by transmission development. Investment will enable a new generation of renewable energy projects and offer new industry to many rural regions. The analysis continues by considering the most pressing barriers to transmission development, placing a particular focus on the many cost considerations which often disrupt otherwise viable expansion initiatives. The final section explains steps being taken at the federal level to foster infrastructure expansion while calling for an expanded role on the part of the Federal Energy Regulatory Commission and other government agencies charged with regulating the interstate transmission of electricity.

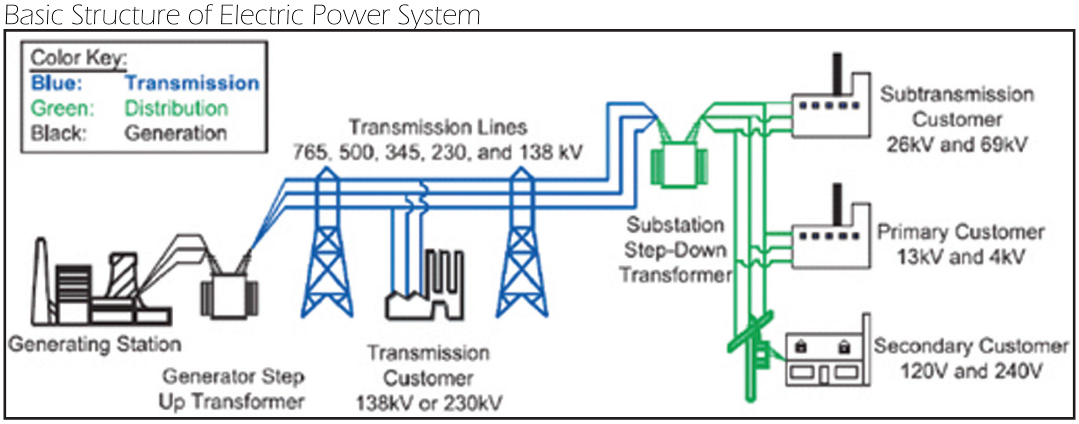
Why Transmission?

Improved transmission is an essential tool moving forward. Expanding the current grid limits congestion, improves reliability, and enables the integration of renewable resources in an effort to meet increased electricity demand. In order to better illustrate the importance of improving transmission infrastructure, this section begins by exploring recent changes in the way in which power lines are used. Shifting demographics and regulatory uncertainty have given rise to unexpected changes. The discussion will then turn to the importance of wind energy and the role transmission plays in enabling this developing industry. Expansion of the electric grid is key to utilizing a vast collection of wind resources. With wind in mind, discourse will then shift to the factors contributing to a recent growth in electricity demand and the role of transmission in providing needed supply.

A. Why Transmission: Changing Needs

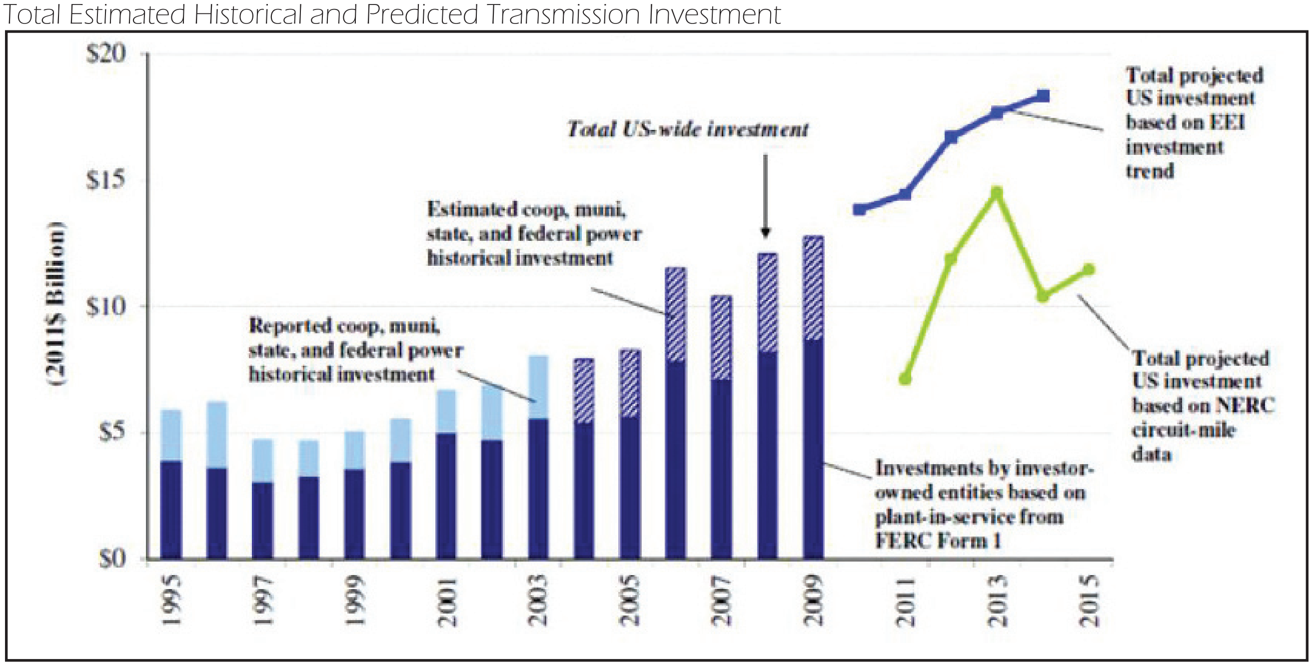
The transmission element of our electrical power system is designed to carry bulk power from the generation source to regions of high demand. Step-up transformers connect the generation facilities to transmission lines, and it is here where the high-current, low-voltage electricity generated is transformed into low-current, high-voltage electricity fit for traveling long distances. These lines bring the electricity to a substation, or step-down transformer, where the voltage is reduced. From there, distribution lines connect to individual customers.

Figure 1:
Basic Structure of Electric Power System



Source: U.S.-Canada Power System Outage Task Force (2004)

Figure 2:
Total Estimated Historical and Predicted Transmission Investment



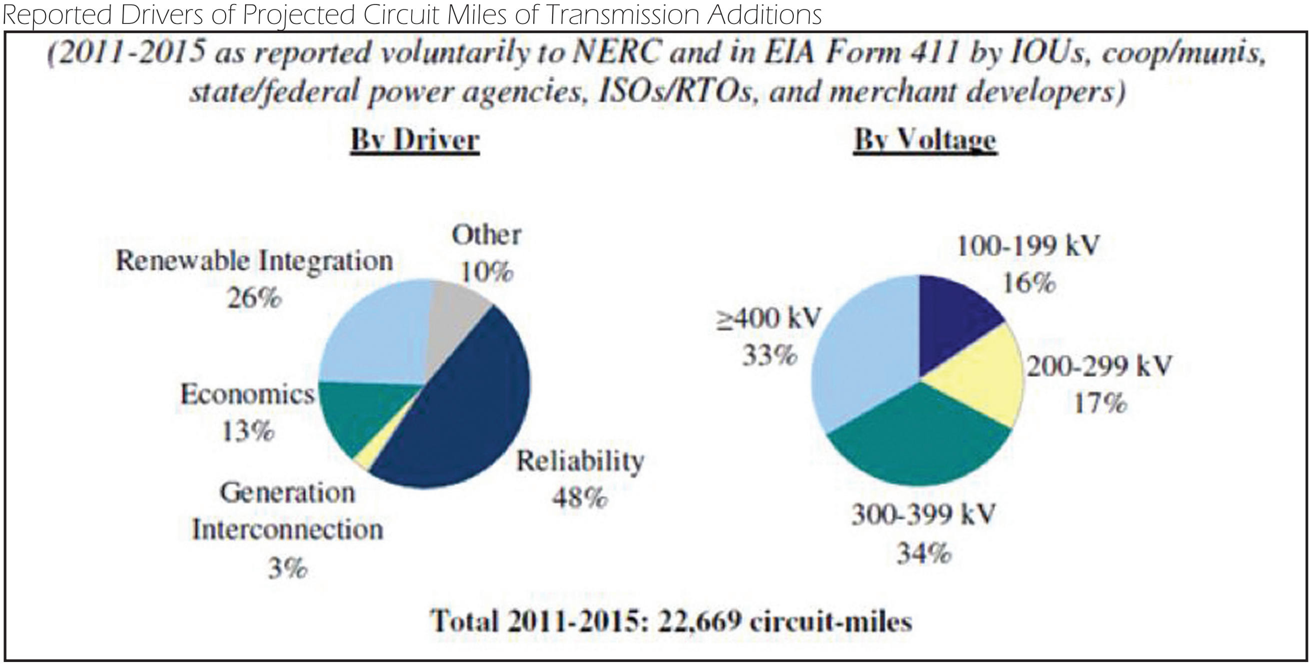
Source: The Brattle Group (2011)

Though much of the original technology used to transport electricity has been retained, our needs have changed. Originally built on a localized level, it was envisioned that the electricity delivered would come from only one generation facility and the lines used in the process would serve just one municipality. Though minimizing the need for long distance transmission lines, this approach has resulted in an arbitrarily linked patchwork of systems which struggle to meet modern needs. Approximately 70 percent of transformers are now over 25 years old, as are 60 percent of circuit breakers. The majority of lines now in use were constructed 30 to 50 years ago.i Meanwhile, growth of electricity demand has exceeded transmission expansion by nearly 25 percent every year since 1982.ii As a result, chronic congestion, limits in our ability to transport power long distances, and an inability to adequately develop renewable energy plague the industry.

This problem is exacerbated by an evolution in regulatory approach. Due to the Federal Energy Regulatory Commission's release of Order No. 888, all public utilities that own, control, or operate facilities used for transmitting electric energy in interstate commerce are now required to file non-discriminatory transmission tariffs that contain minimum terms and conditions of service.[3] Referred to as Open Access Transmission Tariffs, these utilities now must provide access to transmission service on a basis comparable to the service they provide themselves.[4] As a result, transmission lines originally designed to serve only a localized area now carry electricity from multiple generating facilities to serve multiple demand centers. Using the grid in this way places undue stress on transmission infrastructure.

These changes require a modernized electric grid, a need that persists even when renewables are removed from the conversation. Congestion and reliability problems lead to higher electricity prices and service interruption, culminating in an inefficient system costing ratepayers millions in repairs and excess generation. The most conservative estimates indicate that, at a minimum, 30,000 to 40,000 miles of new transmission are needed in the United States by 2030.[5]

Figure 3:
Reported Drivers of Projected Circuit Miles of Transmission Additions

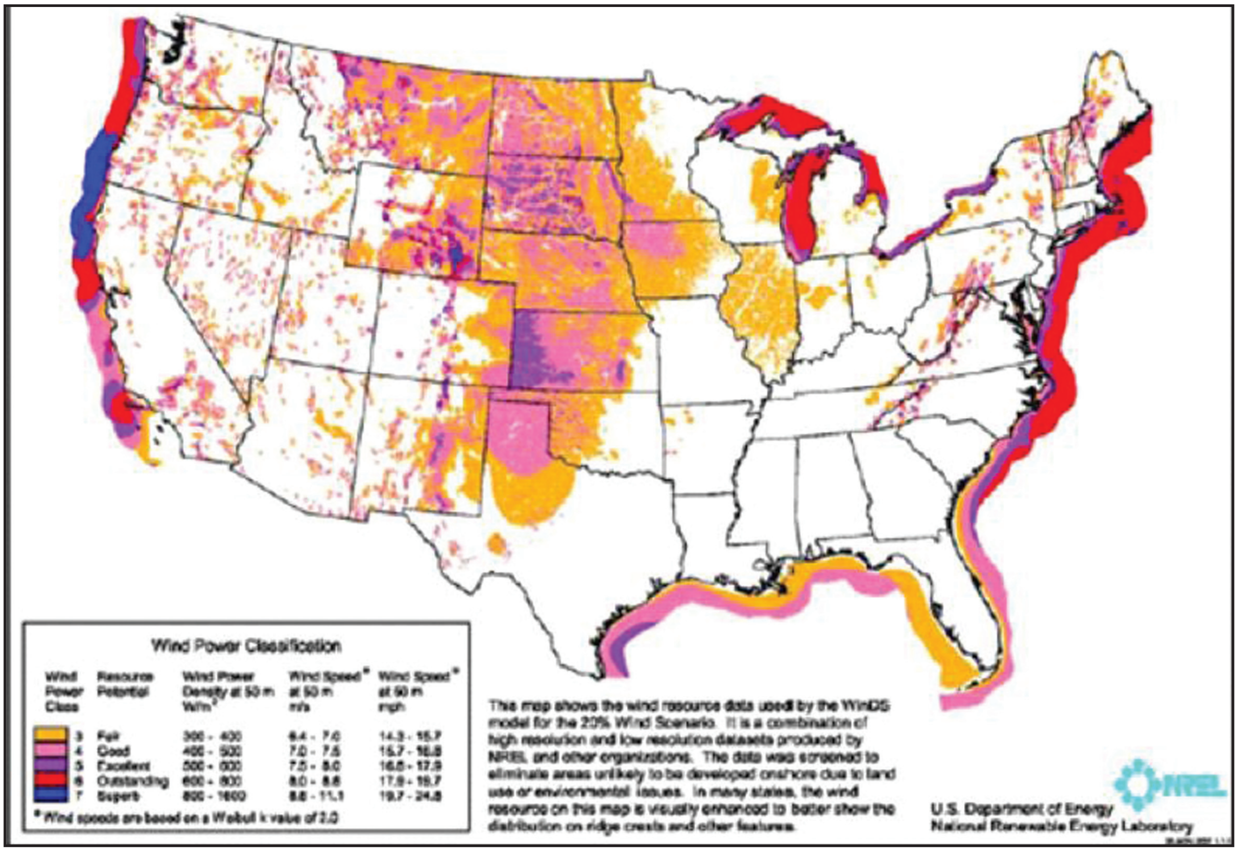


Source: The Brattle Group (2011)

B. Why Transmission: Wind Integration

The failure to improve transmission infrastructure has negative implications for the development of wind power, an essential element of a diversified and cost effective energy portfolio. Resource abundance puts wind in a better position to meet new demand than any other form of renewable energy. In fact, wind is so abundant that it could produce five times more electricity than the United States currently uses.[6] Wind projects represented one-third of all power installed during 2010, adding 5,116 new MW for a 15 percent increase over 2009. This was achieved by building 2,900 turbines, pushing the national total to 35,600. The industry experienced an annual domestic growth rate of 35 percent over the last five years, and 30 percent over the last 10.[7] Wind energy has been the most frequently installed energy technology on a capacity basis since 2008. Our national total is now 40,180 MW, second in the world. [8]

Figure 4:
Wind Resource Potential at 50m Above Ground on Land and Offshore



Source: U.S. Department of Energy, National Renewable Energy Laboratory

Eleven states now produce more than 5 percent of their electricity from wind.[9] Of these 11, most are located in the Great Plains and Upper Midwest, where wind resource potential is most prevalent. Wind provided 15.4 percent of Iowa's electricity in 2010, 12 percent of Minnesota's and 9.7 percent of North Dakota's.[10] These states are joined by South Dakota and Kansas as the five states best utilizing wind as a percentage of total electricity generation.[11]

Due in part to transmission limits, wind industry growth has slowed.[12] Unlike traditional fuels, renewable energy resources cannot be transported. This is a barrier to development as resources are located in areas that lack significant electricity demand and the infrastructure required to bring power to where it is needed most. Over 275,000 MW of wind developments remain unconnected due to a lack of available transmission.[13]

This problem is most ubiquitous in the Great Plains where, with the exception of two lines that span parts of North Dakota and Minnesota, the entire region operates on a handful of 345–499 kV transmission lines.[14] Many others are owned by cooperatives whose sole

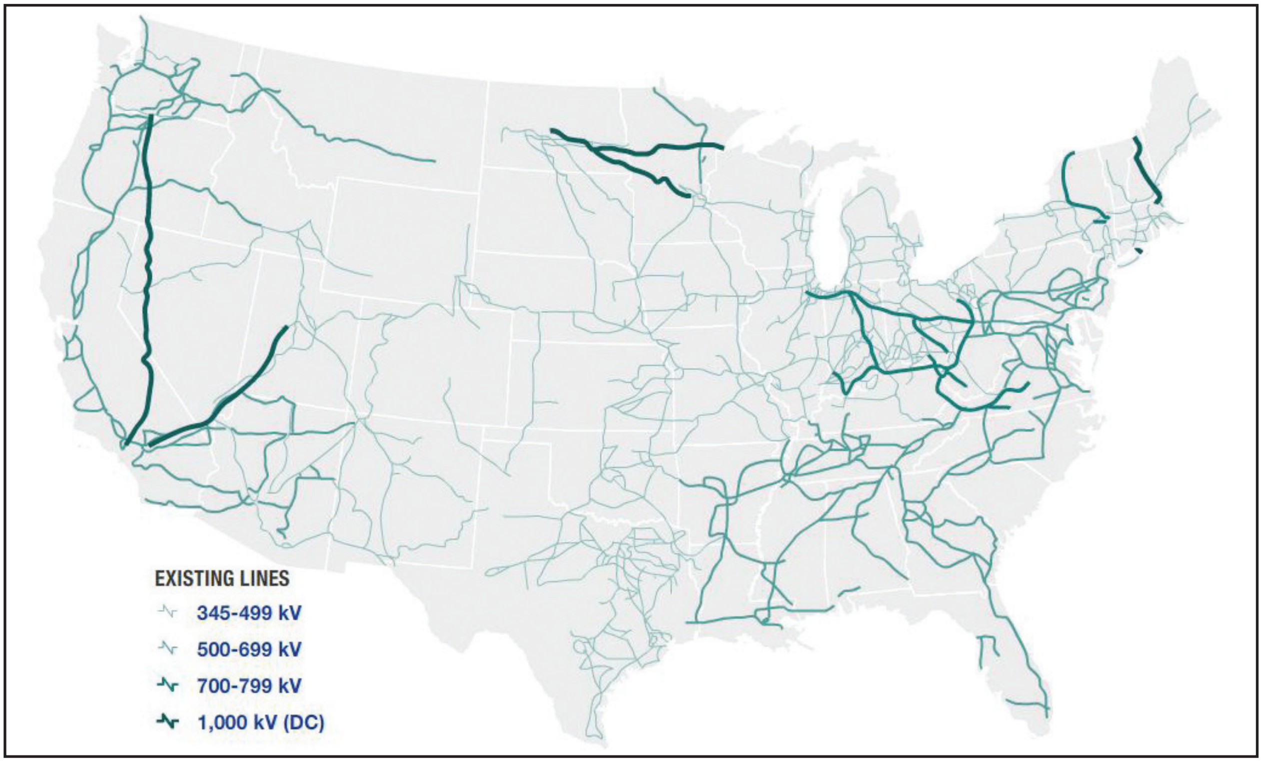
Table 1:
Top 5 States, Largest Percentage of Wind Generation 2010

State	% of Electricity from Wind
Iowa	15.4%
North Dakota	12.0%
Minnesota	9.7%
South Dakota	8.3%
Kansas	7.1%

Source: American Wind Energy Association (2011)

interest is to serve members, not customers in other regions. While this region holds the most wind potential of any, it remains underutilized as a result of an underdeveloped electric grid. In many cases the lack of transmission is the sole deciding factor in analyzing the feasibility of a proposed renewable energy project.

Figure 5:
U.S. Electric Grid



Source: NPR (2010)

Despite cost effective resources, concerns remain regarding the variability of wind. At a time when many are striving to establish an affordable mechanism for storing electricity, the fact that a robust grid will account for the intermittent nature of wind is often overlooked. An improved transmission network will enable wind-generated electricity to travel significant distances. The ability to move wind-generated electricity across the country efficiently eliminates the need for redundant generating facilities. With adequate transmission, up to 40 percent of electricity demand can be met by wind without adversely impacting grid reliability. The cost of accommodating wind generation is less expensive, too; changes in wind output can be accounted for by using slower-acting reserves that cost 1/40 as much as the faster-acting reserves necessary for conventional power plants.[15]

Overcoming the remaining variability of renewable energy sources is in many cases as simple as changing the output of power plants in the same manner adopted for other generation resources. Grid operators have long dealt with variability in demand, adjusting supply as needed in an attempt to find an efficient balance. Due to technological advancement in forecasting systems, grid operators can plan for changes in wind speed days in advance. Regional Transmission Organization initiatives, such as the Midwest Independent System Operator Dispatchable Intermittent Resource Designation, allow the seamless integration of wind resources by instituting a 5-minute market dispatch that treats wind the same as any other resource. This maximizes efficiency while providing for flexible operation.[16]

C. Why Transmission: Meeting Demand

Though tremendous gains have been made in terms of responsible energy use and efficiency, demand for new generation persists. An expanded grid is critical in efforts to meet this need, which arises in four principle forms. First, as outdated coal plants are retired, new sources of generation are needed as a replacement.

Second, as Renewable Portfolio Standards are passed the need for renewable resources grows. Third, demand is created as electricity becomes a substitute for petroleum.

The final source of demand for new generation is economic growth. There has yet to be a period in which electricity consumption did not grow in conjunction with the economy. This principle holds true today, despite technological improvements and renewed focus on energy efficiency.[17] We can therefore assume that any effort to spur growth will lead to a corresponding increase in electricity demand. A study authored by the Energy Information Administration projects this demand to grow by 30 percent over 2006 levels by 2030.[18]

Table 2:
Relationship Between Electricity Consumption and Real GDP

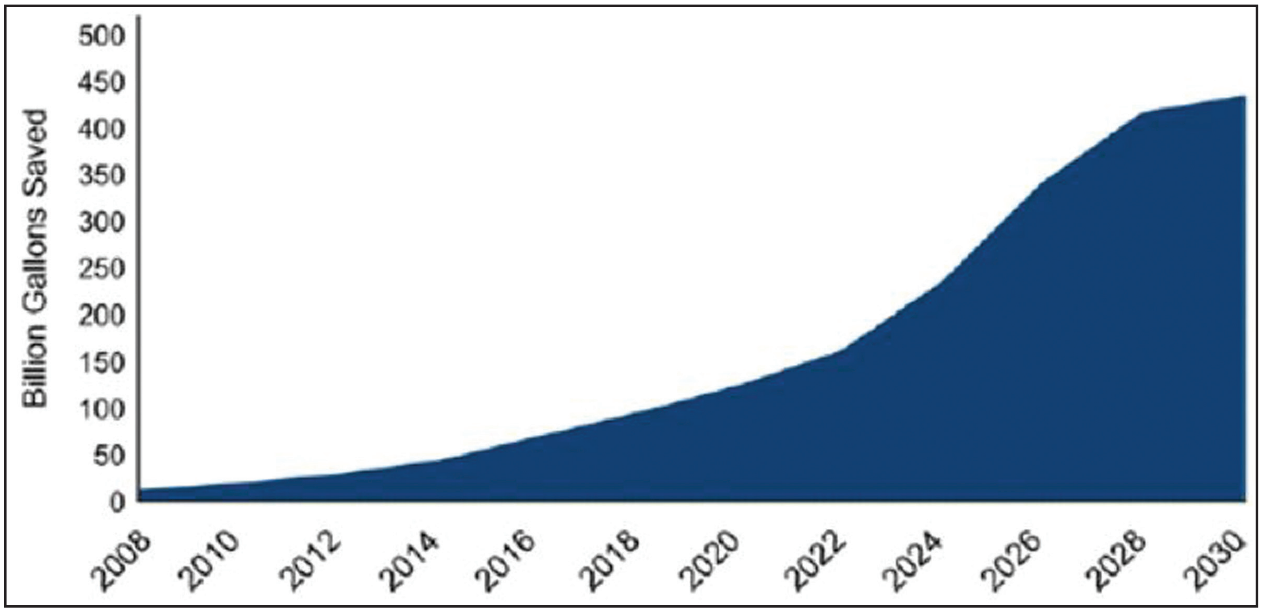
Time Period	Electricity Consumption Growth Rate	Real GDP	Electricity Consumption Growth as a Percentage of Real GDP Growth
1991-2010	1.6%	2.7%	60.4%
1992-2010	1.7%	2.6%	64.5%
1999-2010	1.1%	1.9%	57.0%
1991-2009	1.5%	2.7%	54.3%
1992-2009	1.5%	2.6%	58.2%
1999-2009	0.7%	1.8%	40.1%
1991-2007	1.9%	3.2%	60.8%
1992-2007	2.1%	3.2%	65.0%
1999-2007	1.5%	2.6%	58.0%
2008-2035	1.0%	2.4%	41.0%

Source: National Energy Technology Laboratory (2010)

Additional demand is created by renewable mandates. Along with the District of Columbia, 29 states have adopted renewable electricity standards, policies that require electricity providers obtain a minimum amount of their power from renewable resources by a certain date.[19] Over 70 percent of renewable investment in the U.S. is made in these states.[20] Others, such as Indiana, have adopted voluntary renewable standards.[21] Still more, such as Nebraska, feature individual public power districts that have set standards of their own.[22] As a result, demand for renewable energy now exceeds supply.[23] Approximately 100,000 MW of additional wind generation is needed to satisfy existing state Renewable Portfolio Standards.[24] Because renewable generation is predicted to increase by 2.6 percent per year, 90,000 MW of additional generation would be needed to meet a nationwide 20 percent Renewable Portfolio Standard.[25]

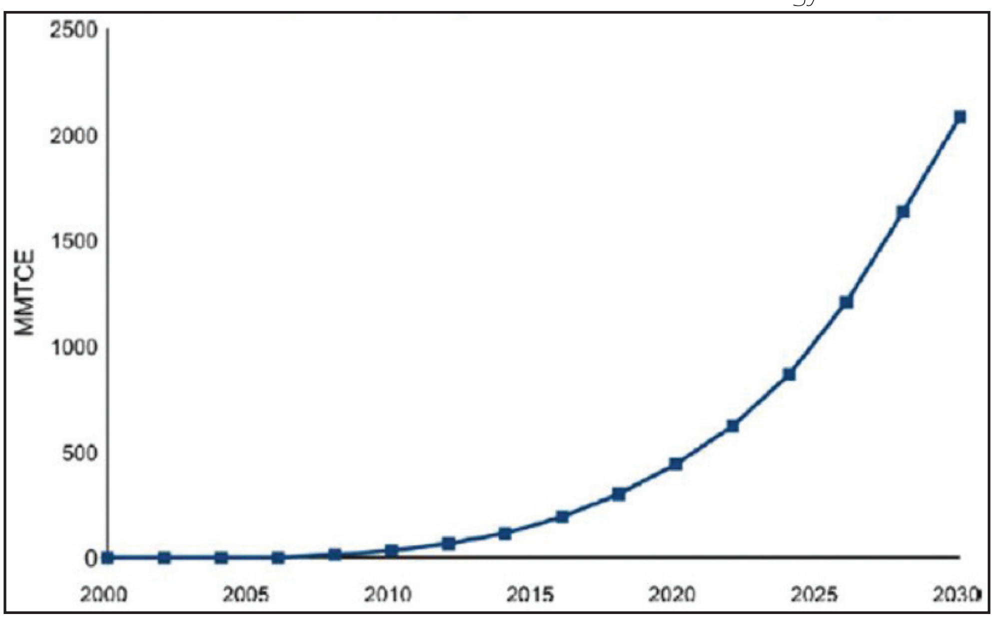
There is also an impressive amount of renewable energy demand dictated by consumer preference. Projected oil prices and concerns over both health and climate change render renewable energy sources the most attractive option in efforts to meet our electricity needs. A recent study shows that 90 percent of consumers want more renewable energy, largely due to concerns regarding the environmental problems caused by conventional energy sources.[26] Wind is attractive because this resource degrades neither air nor water quality. Both combustion and the use of water are unnecessary, avoiding harmful pollutants and limiting the spread of greenhouse gases. Almost every MWh of wind power displaces an equivalent amount of electricity that would have otherwise been generated by a fossil-fueled power plant.

Figure 6:
Annual Water Consumption Savings due to Deployment of Wind Energy



Source: National Renewable Energy Laboratory (2010)

Figure 7:
Cumulative Carbon Emission reductions Attributed to Wind Energy



Source: National Renewable Energy Laboratory (2010)

For others, this resource has become attractive due to a gradual price decrease. Technological improvements have ensured that wind energy is cost competitive with other fuel sources. Power from conventional coal costs approximately $68 per MWh. Conversely, electricity generated from projects built in high wind areas cost approximately $65 per MWh.[27] Power purchase agreements for new projects are contracting at a rate of 5 to 6 cents per kilowatt-hour, similar to the price paid for energy generated by new natural gas plants.[28] Because there are no fuel costs, wind farms maintain low operating expenses and provide a predictable source of supply.

Energy conservation is also important to the health of this nation's economy and is a solution that must not be overlooked. Like renewable resources, energy efficiency is capable of creating jobs in areas such as manufacturing and construction. Efficiency is environmentally beneficial as the prudent use of energy avoids many of the most damaging consequences associated with electricity generation. Nevertheless, it is likely that demand will grow beyond the purview of efficiency. Whether this happens during the next year or during the next decade, it is important that ample thought is given to the next source of generation. Increasing demand, consumer preferences, technological improvement and safe, domestic sources make wind energy the most attractive solution.

Transmission and Economic Opportunity

While the need for improved transmission transcends economic considerations, this section focuses on job creation potential and the impact of an enabled wind energy industry. The conversation begins by highlighting the immediate employment potential of transmission development. Next, the economic potential of wind development will be considered. Transmission improvements lead directly to growth in the renewable energy industry, and applying these numbers to the expected benefits of wind energy investment confirms that renewable energy development has the potential to revitalize the economy of rural America. Finally, these jobs will change the complexion of many rural communities. As the states with the greatest wind power potential tend to be rural and sparsely populated, wind development is a welcome prospect.

A. The Economic Potential of Transmission Development

Table 3:
Economic Impact of Expected Build-Out

Annual Transmission Capital Cost	Annual FTE Jobs Supported		Annual Total Economic Activity Stimulated
(2011$ Billion)	Direct	Total	(2011$ Billion)
$12	51,000	150,000	$30
$16	68,000	200,000	$40

Source: The Brattle Group (2011)

Grid modernization represents a major potential source of job creation. By some estimates, transmission investment in the United States will range from $12 billion to $16 billion annually through 2030. Every $1 billion of U.S. transmission investment supports approximately 13,000 full-time equivalent years of employment.[1] Accordingly, over a 20 year period 150,000 to 200,000 full-time equivalent years of employment could be created annually simply by updating and expanding transmission infrastructure.[29] Over one-third will be supported directly by domestic construction, engineering, and transmission component manufacturing activities.[30] Approximately 125 operations and maintenance positions are created per $1 billion of transmission additions, in many cases providing employment throughout the life of the project.[31]

As in the case of renewable energy development, these jobs pay well: annual wages associated with transmission construction averaged $65,300, compared with an average of $33,760 across all industries.[32] Once this money is invested in the local community – attracting new businesses, new residents, and new investment – the output from this investment impacts everyone to a tune of $30 billion to $40 billion per year.[33]

While these numbers are meaningful in the abstract, it's instructive to consider projects currently in progress.[2] For example, an additional 520 full-time operating and maintenance jobs will be created in Wyoming once construction of a proposed transmission expansion is completed.[34] Clean Line Energy is claiming that approximately 5,000 temporary construction jobs and 500 permanent jobs will be created once construction of their 500 mile, 500-kv Rock Island transmission line begins.[35] Though frequently overlooked, tax revenue generated by transmission projects can go a long way in supporting local schools and businesses. The CapX2020 project, a joint initiative of 11 transmission-owning utilities in Minnesota and the surrounding region, is expected to generate federal and state tax revenues of $92 and $52 million, respectively.[36]

Additional benefits will be realized by ratepayers. Improved transmission increases competition in power markets while enhancing reliability and minimizing congestion. This leads to reduced transmission losses and production cost savings. In some cases, strategically placing a new transmission line is enough to avoid the construction of additional fossil fuel generating facilities altogether. Within the same interconnection, improving transmission in one region will likely increase reliability in another. Further benefits will be realized in the diversifi-

1 The impact of this investment is best measured by using the term "full-time equivalent", where one job equates to one year of full-time employment. This metric allows for consistent comparison across projects. For example, 10 full-time equivalent years of employment is equal to one full time job anticipated to span a 10 year period. 1,000 full time equivalent years of employment equates to 100 full time jobs anticipated to span a 10 year period.

2 Employment statistics related to operation and maintenance are assumed to span a period of 40 years. Employment statistics related to construction are assumed to span a period of 10 years.

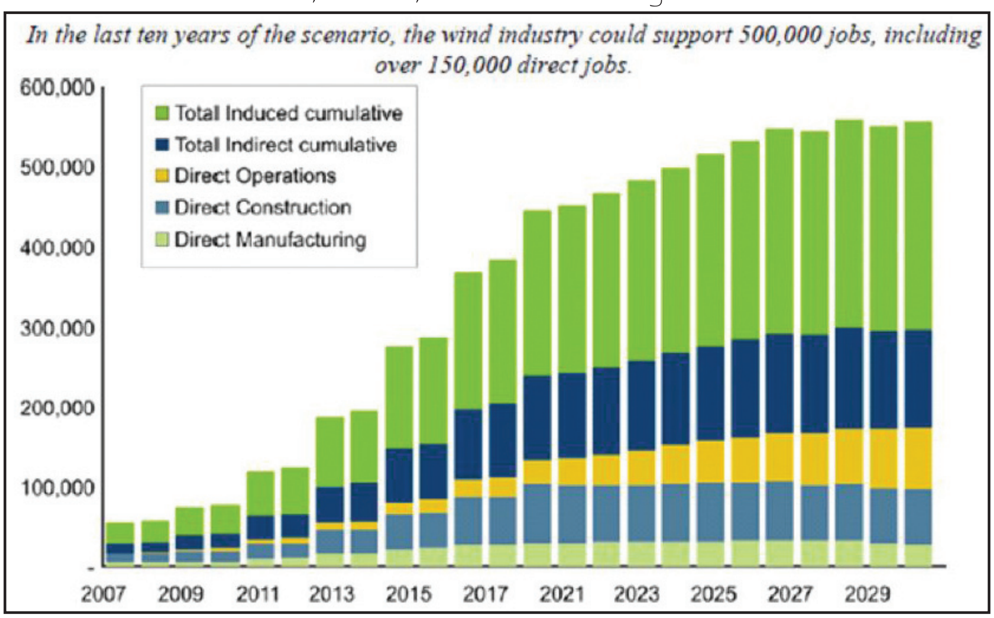
cation of a region's generation portfolio and a corresponding decrease in the wholesale price of electricity.

B. The Economic Potential of Wind Development

It is important to consider the benefits of a transmission build-out in conjunction with the renewable energy development this will enable. A greater commitment to the development of wind resources translates into growing businesses and expanded employment opportunities throughout America. Every $1 billion of wind generation investment supports a total of approximately 12,500 full-time employee years of employment.[37] Whether highly skilled or professional, in urban areas or rural, each new wind project will bring jobs. In the past 4 years, jobs in the renewable energy sector grew nearly 8 times as much as jobs associated with conventional energy.[38] Over 225,000 clean energy jobs were created or preserved in the third quarter of 2010 alone.[39]

For the most part, immediate opportunity will be realized by meeting mandates already in place. As noted, a survey taken in May 2011 shows that approximately 100,000 MW of additional wind generation is needed to satisfy existing state Renewable Portfolio Standards. An additional 90,000 MW would be needed to meet a 20 percent federal Renewable Portfolio Standard, an important consideration should this policy reemerge. Assuming an average cost of $2,100/kW of installed wind capacity, $210 billion to $400 billion will be needed in order to install the wind capacity necessary to meet standards already in place. This level of investment translates to approximately 2.6 million to 5 million full-time equivalent years of employment in total. Put another way, 130,000 to 250,000 full-time jobs will be created each year of a 20 year period.[40]

Figure 8:
Jobs Per Year from Direct, Indirect, and Induced Categories



Source: U.S. Department of Energy (2008)

To put this potential into perspective, consider the state-by-state economic impact of generating 20 percent of our electricity needs from wind.[3] In Iowa, this would require 19,909 MW of new development, leading to 63,401 new construction jobs, and 9,011 long-term positions in operation and maintenance. This results in an economic benefit of $21.4 billion.[4] Meeting a 20 percent standard would require 9,942 MW of new development in Minnesota, creating 29,671 new construction jobs and 4,071 long-term positions in operation and main-

3 Employment statistics related to operation and maintenance are assumed to span a minimum period of 20 years. Employment statistics related to construction are assumed to span a period of 1-2 years.

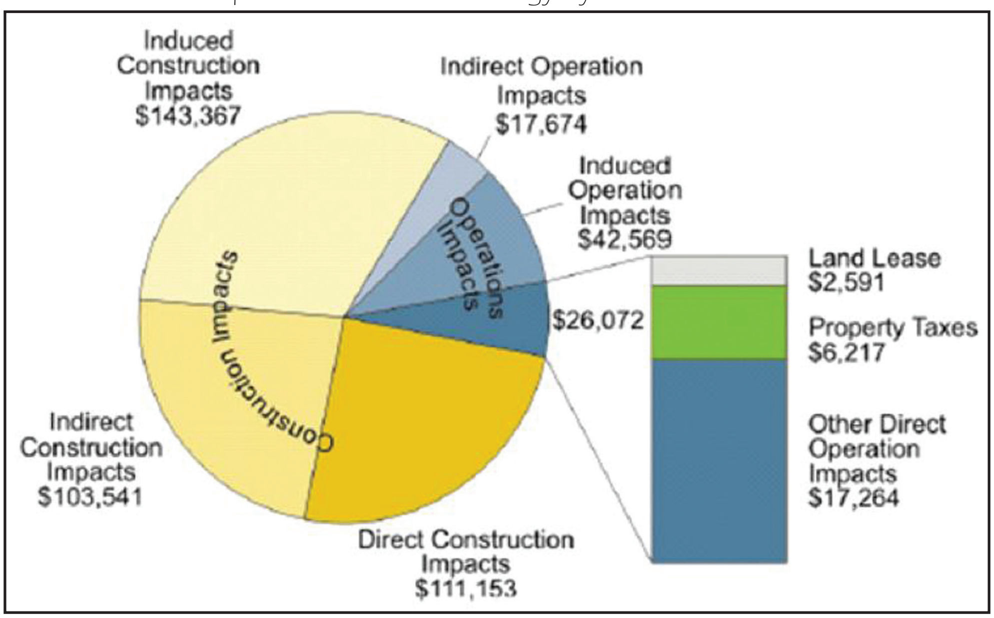
4 For this study, "total economic benefit" includes: payments to landowners, local property tax revenue, and salary forecasts for each new position.

tenance. This results in an economic benefit of $11.2 billion. 7,880 MW of new development would be needed in Nebraska, leading to 25,988 new construction jobs and 3,558 long-term positions in operation and maintenance. The total economic impact here is $8.9 billion.[41]

Expected openings span fields such as wind turbine component manufacturing, construction and installation or maintenance and operations. At least 50 percent of U.S. turbine components were sourced domestically in 2010, up from 25 percent in 2005. After adding 14 new manufacturing facilities in 2010, the U.S. now has a total of 400 spread across 44 states.[42] New jobs will be crated in legal and marketing fields, public relations and logistical services. In 2010 alone, the wind sector invested $10 billion in the U.S. economy and employed 75,000 workers with 31 manufacturing facilities opening during this same period.[43]

Landowners will also benefit from income received by virtue of having wind turbines located on their property. This provides farmers with a second crop to harvest. As each wind farm uses only 3-5 percent of the land, most continue their operation with no interruption.[44] Many landowners receive up to $10,000 per year simply by having one turbine on site; some have contracts that require an additional 2 percent periodic increase in easement payments.[45]

Figure 9:
Total Economic Impacts of 20% Wind Energy by 2030



Source: U.S. Department of Energy (2008)

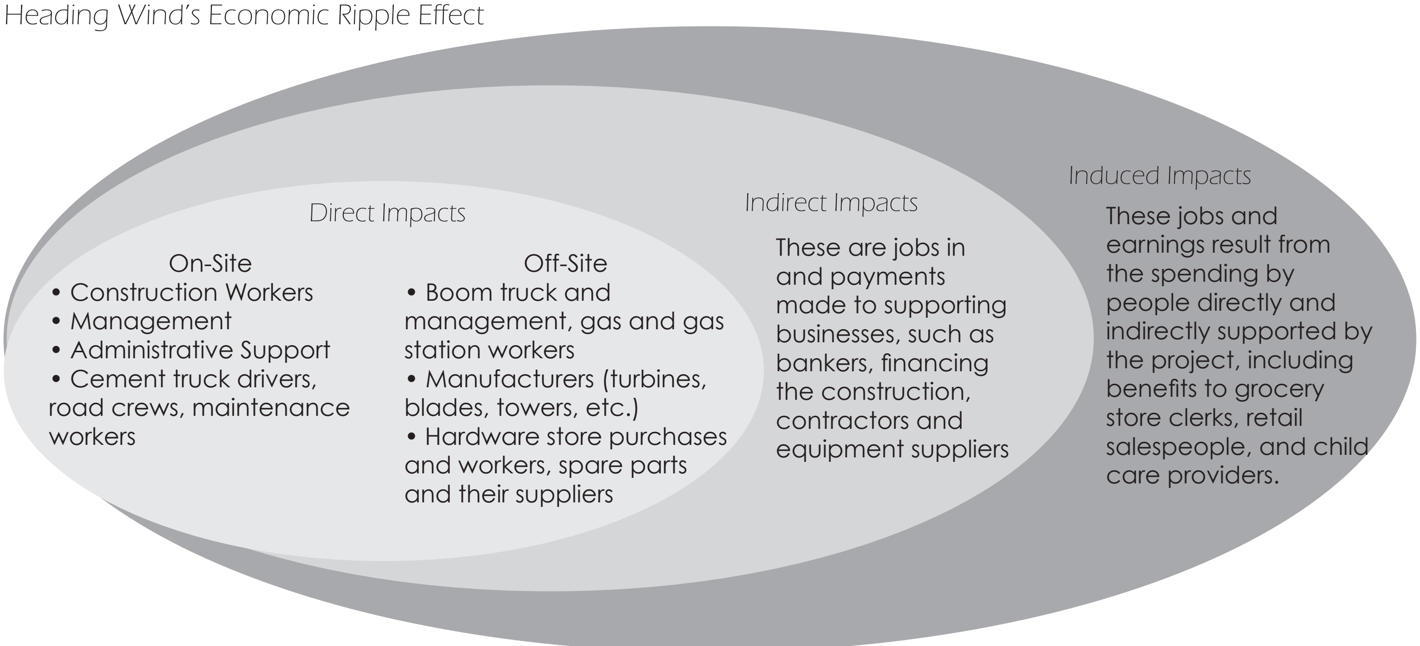
New wind developments also create significant tax revenue. Solidifying the tax base of a county or municipality leads to better schools, safer roads and improved infrastructure. This is primarily realized through property taxes, where every 1000 MW of wind developed in southwest Minnesota leads to $1 million per year in property tax revenue.[46] Accepted scenarios predict more than $8.8 billion in estimated property taxes and land lease payments between 2007 and 2030.[47] Any benefits realized are likely to reverberate throughout the region indirectly, providing a boost to core industries such as agriculture and reinvigorating stagnant trades such as manufacturing and construction. This revenue can also come in the form of zoning and permitting fees, as in the case of a 29-turbine development in Logan County, Illinois which led to a $245,000 increase in municipal funds.[48]

C. Transmission Expansion and Rural Development

Similar to wind energy projects, transmission infrastructure will be built in remote areas throughout rural America. As a result, the rural economic impact of improving transmission infrastructure can be substantial. Wind projects tend to have the greatest direct impact on small communities, which are often less economically diversified. Because population trends track employment opportunities, the potential offered by the development of renewable projects is especially profound here.

The employment potential offered by transmission expansion comes in three principle forms. Direct effects include permanent jobs, the wages from these jobs and the revenue generated from the actual project. These will bring opportunity to those willing to participate in the construction and assembly of the wind turbines and transmission infrastructure required to make this transition a reality. Indirect effects include the jobs, wages and output created by the businesses which provide the materials necessary for each project. Those supplying the goods and services needed in the development process will enjoy increased activity. Induced effects, the economic activity generated by the re-spending of wages by those employed in the industry, have the potential to keep the local grocery store open or the cafe in business.[49]

Figure 10:
Heading Wind's Economic Ripple Effect



Source: U.S. Department of Energy (2008)

To date, much of the rural economy has been built on three pillars: natural amenities, natural resources, and manufacturing.[50] Unfortunately, these pillars are no longer as strong as they once were. As a result of these changes, it is critical for rural economies throughout America to diversify. Many jobs can now be found in the service sector. Education, health care and retail trade support families throughout the Great Plains and Upper Midwest.[51] Renewable energy projects offer communities an opportunity to reinforce the pillars of manufacturing and natural resources, providing a source of diversification as well as a source of income. Further, these projects are made possible by a set of unique attributes only rural areas can offer: a combination of abundant renewable resources; large, sparsely populated tracts of land; and a strong work force. Locating component and turbine manufacturing facilities close to areas with renewable resources will lower project costs while bringing welcome opportunity. In fact, local governments may offer incentives to the developer who chooses to do just that.[52]

Challenges to Transmission Expansion

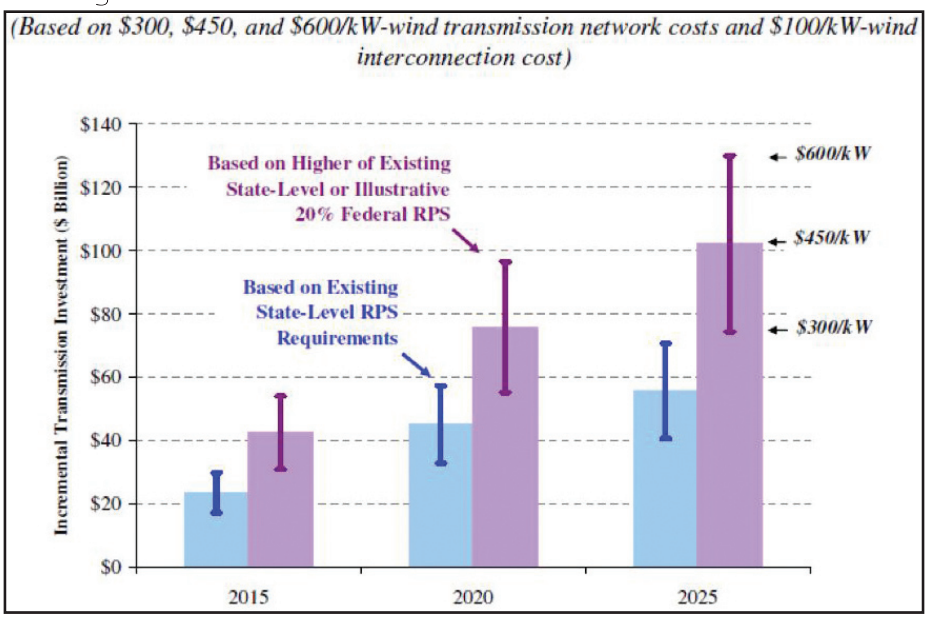
While expanding the grid will be met with a host of challenges, assigning cost to the various parties involved is chief among them. This section will first consider cost allocation principles and the difficulties encountered by utilities wishing to expand their transmission portfolios. The focus will then shift to the challenges faced by renewable energy developers in connecting their project to the grid. Lastly, the role of regulation will be considered. It will be seen that much is to be desired if an efficient, comprehensive process is the ultimate goal.

A. Paying for Improvement: Expanded Infrastructure

Despite the benefits associated with an expanded transmission system, obstacles remain. The primary barrier stems from disagreement regarding cost allocation. This, combined with questions surrounding jurisdictional coordination and a fractured regulatory approach, is largely responsible for the current state of our transmission infrastructure – and the root of numerous concerns going forward.

Though estimates vary, transmission expansion costs are estimated to range from $60 billion to $300 billion over the next 20 years.[53] Others estimate that moving wind power from the places where it is most abundant, such as the Great Plains, to the places where it is needed most, such as the demand centers of the East Coast, may cost anywhere from $49 billion to $80 billion.[54]

Figure 11:
Heading: Estimated Renewable-Related Transmission Investment Need



Source: The Brattle Group (2011)

While it is indisputable that the cost of this investment will be significant, agreement ends there. Assigning cost is complicated by FERC Order No. 888 under which a commonly accepted formula for enabling and encouraging investment in new transmission infrastructure has yet to arise.[55] As mentioned previously, electricity had historically been provided to each locality by one utility, using minimal generation facilities. Utilities paid for the transmission lines used to connect their customers, resulting in a series of single-utility, single-state projects, built primarily to satisfy reliability needs. This is no longer possible under open access reform. Transmission lines are open to any generating facility wishing to provide electricity, regardless of location. Since energy is bought and sold on the open market, it isn't always clear which generating facility will be using an individual transmission line at a particular time. Who will benefit is equally unclear. No longer can the ratepayers of one particular municipality be expected to foot the bill. The transmission line may transport power 500 miles away, not only serving distant load centers but improving reliability and minimizing congestion everywhere in between.

Cost allocation becomes particularly contentious when a transmission line spans multiple states. Under this scenario, it is difficult – to date, almost impossible – to decide which stakeholders will pay for the proposed project. This is especially true when benefits accrue to municipalities outside the states in which the new lines will be located. Those who see only a small or difficult to quantify benefit protest the prospect of paying anything.i This challenge has led the Electricity Advisory Committee of the DOE to conclude, "cost allocation is the single largest impediment to any transmission development."[57]

It is unlikely that transmission infrastructure will be significantly improved in the absence of an agreed upon approach. Some argue that broadly inclusive regional and sub-regional transmission planning is the best solution. Many find this argument justified due to the fact that, in a synchronized grid, all ratepayers benefit to some extent from new transmission lines. Others suggest that any approach to cost allocation should adhere to a "beneficiaries pay" principle.[58] While this method has merit, the difficulty of determining and quantifying the precise benefits to assess and the challenge in deciding which population subset benefits most cannot be overlooked. Still others propose a "postage stamp" cost allocation method, where costs are spread evenly across an entire network. This approach becomes less feasible, however, as the project increases in geographic scope. Many of the same complaints regarding the "beneficiaries pay" principle are present here.

Whatever the competing interests and whichever approach is chosen, it is critical that agreement is reached. An emerging trend indicates that some companies are willing to pay for expansion themselves. Costs are then recuperated solely through fees charged to generating facilities who use the lines to transport electricity. While this concept has merit and will assuage many concerns, the long term willingness of private investment firms to undergo significant risks has yet to be determined.

B. Paying for Improvement: Renewable Integration

Another important question that must be addressed is the extent to which renewable power is considered in transmission expansion plans and proposals, and whether renewable project developers should be responsible for financing expansion efforts.

This dispute arises in the early stages of project development. Developers often cannot secure funding, as most lenders are hesitant to offer support when the infrastructure necessary to deliver power to demand centers is not yet built. Conversely, lenders are hesitant to support transmission projects designed to connect resource-abundant areas to demand centers simply because the generation facilities that would exploit those resources are not present.

Because of this, the question for many renewable project developers asks exactly how much of the cost of a new transmission line the developer will have to bear. The second relates to the cost of physical connection. The equipment used to connect the generating facility to actual power lines can be costly. The third issue, which varies greatly between jurisdictions, relates to system charges or network tariffs.[59]

The assignment of these three costs will often determine the financial feasibility of a particular renewable energy project or group of projects. It is important that a balance is found. When a "shallow" cost allocation approach is used, imposing the majority of costs on those undertaking transmission development, that company may be dissuaded from expanding transmission infrastructure altogether.[60] This isn't the outcome preferred by the utility, and certainly is not ideal in the mind of the developer.

C. Paying for Improvement: The Role of Regulation

Poor jurisdictional coordination in transmission siting and approval is a leading impediment to improving transmission infrastructure. This deterrent is manifested in a culture of uncertainty, inevitably resulting in tedious rounds of negotiation and litigation, often times delaying a project or eliminating plans altogether. This is compounded by a lack of federal oversight.

Because land use laws are governed by individual states, and interstate transmission lines require a permit from each state in which it is located, the permitting process can be time-consuming. This is especially true when it is perceived that one particular state will receive no benefit from a transmission line passing through its borders. The lack of consistency among regional and state level planning agencies has rendered the process unpredictable. What's more, regulators and utilities are limited, typically by state law, in the benefits they can consider for a particular project. If these legally mandated benefits are absent or insufficient, not only will siting approval be denied, but cost recovery becomes an unlikely proposition.

The absence of federal oversight only makes matters worse. There is no federal organization available to take charge of needed interstate transmission projects. The Energy Policy Act of 2005 attempted to address the problem by assigning FERC backstop authority over needed but delayed projects.[61] This authority would allow FERC to override state siting decisions in select cases. However, similar to FERC attempts to establish universal cost allocation principles, this delegation has been challenged in federal court and is now under question.[62] As a result, only 14 interstate high-voltage transmission lines were built between 2000 and mid-2007, spanning a distance of 668 miles.[63]

Moving Forward

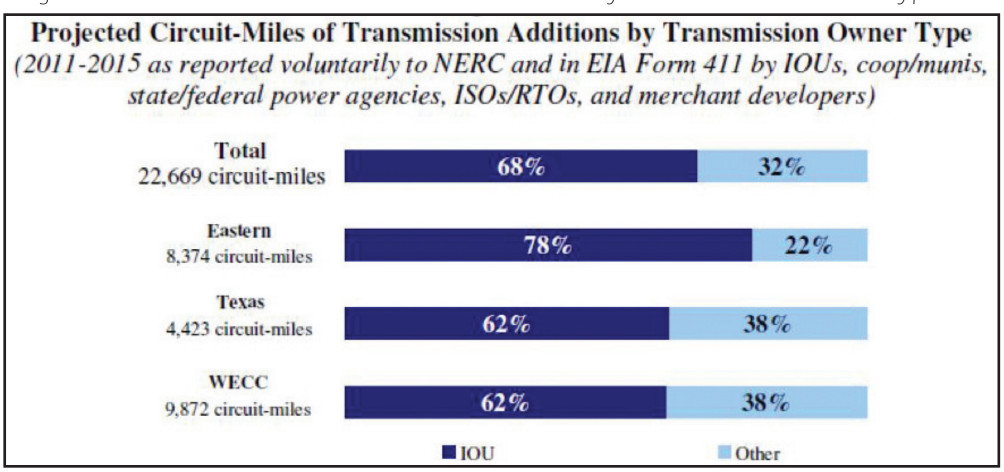
In order to properly address these challenges and fully realize the benefits of developing transmission infrastructure and renewable energy capacity, it is critical that a sound and effective approach is taken going forward. This section reviews the level of investment currently being made and points out many areas which deserve renewed effort. This is followed by a summary of the challenges discussed throughout this paper, followed by proposed solutions. It will be seen that recent changes to the electricity industry have, like so many other sectors, brought forth national – opposed to regional or state based – considerations.

A. Moving Forward: Investment Needs

Investment in transmission infrastructure must escalate in order to meet increased electricity demand. This need becomes even more urgent as we target renewable resources. As noted previously, $3.1 billion to $5.5 billion per year must be set aside to focus on renewable integration simply to meet existing Renewable Portfolio Standards. The total increases to $6.3 billion to $10 billion per year in the event of a 20 percent federal standard, or state equivalent.[64]

Progress is being made. Transmission investment has increased significantly over the past decade, particularly with respect to investor-owned utilities. These utilities have quadrupled spending, from approximately $2 billion per year in the 1990s to $8 billion to $9 billion per year during 2008 and 2009. In fact, up to 69 percent of all transmission infrastructure investments made can be attributed to investor-owned utilities.[65] In 2007 these investments reached a 30 year high of $6.5 billion. The total spent in 1998 was $2.1 billion.[66] Today over $180 billion of proposed or conceptual projects are currently underway, many of which are being built to support further integration of renewables.[67] Only $25 billion of these projects have been approved by the relevant Regional Transmission Organization, however, and up to one-half of the remaining projects will not be realized due to overlaps with competing efforts, siting and cost allocation challenges, and prohibitive pricing.[68]

Figure 12:
Projected Circuit-miles of Transmission Additions by Transmission Owner Type



Source: The Brattle Group (2011)

This investment has varied geographically. Approximately 70 percent of total transmission investments are made in the Eastern United States, compared with 25 percent in the West.[69] As many of our most abundant wind resources reside in the Upper Midwest and Great Plains, these trends imply that transmission investment is being made in the interest of promoting reliability and avoiding congestion, with integration of renewables playing a minimal role. Reliability needs have again surfaced as the motivating factor behind the majority of all projected circuit-mile additions for 2011-2015.[70]

B. Moving Forward: Regulatory Needs

Any approach to transmission expansion will almost certainly relieve congestion and improve reliability. It is critical that this be achieved while simultaneously integrating renewable resources, particularly those located in remote areas. While the financial obstacles to transmission expansion are considerable, an assortment of policy barriers must also be overcome. Chief among these are questions regarding cost allocation, planning and siting. While local interests dominated the transmission debate for many years, the interstate nature of the electricity industry has given rise to a new set of concerns. Many now agree that the federal government must assume an active role as planning efforts move forward.

Providing the Federal Energy Regulatory Commission (FERC) with increased authority may be the most logical choice. For example, allowing this agency to designate 'renewable energy zones' with near complete authority over the region would place focus on areas of abundant renewable resources and encourage their development. As mentioned, the Energy Policy Act of 2005 took an important step in this direction by providing FERC preemptive authority over transmission line development in designated national energy corridors. More specifically, FERC was given authority to issue permits for projects within these corridors whenever a state has withheld approval for longer than one year. This was interpreted to mean that the agency is given authority to override a state commission that has denied a project permit outright. In other words, FERC authority would apply not only when a state commission has simply failed to act, but also when their action resulted in denial. While this interpretation was reversed by the U.S. Court of Appeals for the Fourth Circuit, the issue has been raised and further litigation, if not legislation, can be expected.[71]

Another option garnering support is the idea of a nationwide transmission 'superhighway', similar to the interstate highway system now in place. The purpose would be to transport renewable energy from where it is most abundant to where it is needed most. This undertaking would begin in areas of resource abundance such as the Southwest and Great Plains, extending to demand centers in the East and West.[72] Such an arrangement would require federal preemption of state siting and a cost allocation model that serves the interstate nature of the project.[73] To this end, FERC has issued a proposed rule that would remove much of an individual state's siting power, instead requiring transmission planning to be handled regionally. Any regional effort would then take into account state or federal public policy, such as Renewable Portfolio Standards.[74] In furtherance of this solution, FERC has proposed a cost allocation scheme in which costs would be paid for by customers "at least roughly commensurate" with the estimated benefits they receive.[75] While these policies are not yet in place, efforts are being made to overcome the regulatory hurdles associated with interstate transmission planning.

A final option can be found in congressional efforts that promote policies which would indirectly lead to needed transmission expansion. Examples include a federal Renewable Portfolio Standard, significantly increased support for renewable investment, or any other policy seeking to cap greenhouse gases as part of comprehensive climate legislation. While this approach has merit, whether it would be enough to spur a significant transmission upgrade is unclear. Simply creating a need for improved infrastructure may very likely result in renewable projects being built closer to demand centers, an approach which would be considered inadequate to those advocating for the utilization of our most abundant, though remotely located, renewable resources.

Regardless of the path taken, it's clear that the federal government must assume a greater role in enabling a national solution. Inaction on the part of Congress will allow states to persist in making local transmission siting decisions that meet only the limited needs of their constituents. Business-as-usual has left much to be desired, and as the available numbers indicate, has resulted in missed economic opportunity on the part of all involved.

Conclusion

It is difficult to overlook the economic potential found in improving and expanding the electric grid, thus better utilizing our abundant wind energy resources. Wind power and associated transmission investments represent a new way for communities to flourish, for individuals to find good paying jobs while remaining close to family, and for schools to grow. The relationship between renewable energy and rural economic health holds increasing importance at a time when conventional energy sources are struggling to meet the needs of an evolving economy.

While it is true that considerable commitments to clean energy development have been made, policies meant to integrate this power into our existing grid system have fallen behind. A comprehensive effort to improve transmission infrastructure will function as a catalyst for growth. This growth, however, will not be realized without a set of policies that encourage interstate cooperation and provide for an equitable cost share structure.

There are now 11 new transmission projects underway nationwide, enough to connect 29,000 MW of wind power.[76] No matter the approach taken, it's clear that any expansion will have lasting consequences for much of the population – urban, rural, and everyone in between. Improving and expanding the electric grid will represent a commitment to renewable energy, offering opportunity for change when change is needed most. By capitalizing upon this vast and affordable resource we are committing to a solution for our communities, our future and ourselves.

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