Exhibit No: ____
Issues: Need, Benefits, Environmental Impacts and Economic Feasibility
Witness: Michael Goggin
Sponsoring Party: Wind on the Wires & The Wind Coalition
Type of Exhibit: Rebuttal Testimony
Case No: EA-2014-0207
Date Testimony Prepared: September 15, 2014

MISSOURI PUBLIC SERVICE COMMISSION

DOCKET NO. EA-2014-0207

REBUTTAL TESTIMONY

OF

MICHAEL GOGGIN

SUBMITTED ON BEHALF OF:

WIND ON THE WIRES and THE WIND COALITION

SEPTEMBER 15, 2014

TABLE OF CONTENTS

1. INTRODUCTION

Q: Please state your name, job title, and business address.

A: My name is Michael Goggin, and I am the Director of Research for the American Wind Energy Association ("AWEA"). My business address is 1501 M St NW, Suite 1000, Washington DC, 20005.

Q: For whom are you testifying?

A: I am testifying on behalf of Wind on the Wires and The Wind Coalition (collectively referred to as 'Clean Energy Intervenors').

Q: Have you testified in proceedings in front of the Public Utilities Commission ("PUC") before?

A: Not in Missouri, but in several transmission proceedings before the Illinois Commerce Commission, the Minnesota Public Utilities Commission and the Public Service Commission of Wisconsin.[1]

Q: What is your background and educational experience?

A: I have covered transmission and grid integration issues for AWEA since February 2008.[2] Before that, I worked for Sentech, Inc., an energy consulting firm, and for two environmental advocacy groups before that. I have an undergraduate degree with honors from Harvard University.

Q: What is the purpose of your testimony?

A: I provide testimony responding to Grain Belt Express witnesses Skelly, Berry, Loomis and Moland. My testimony supports the finding that the Grain Belt Express Project ("GBE Project" or "Project") will allow greater

---

[1] The Illinois Commerce Commission transmission cases include the Illinois Rivers project (Docket No. 12-0598), Rock Island Clean Line project (Docket No. 12-0598), and Grand Prairie Gateway project (Docket No. 13-0657), the case in Minnesota was the Interstate Transmission Company's Minnesota to Iowa 345 kV line (Docket No. ET6675/CN-12-1053) and the case in Wisconsin was American Transmission Company's Badger-Coulee line (Docket No. 5-CE-142).

[2] *See* Résumé of Michael Stephen Goggin attached as Schedule MG-1.

amounts of low-cost wind energy resources to reach consumers in Missouri as well as other states in MISO and PJM. The combination of transmission and wind can lower the cost of electricity for consumers by lowering wholesale electricity prices and lowering the cost of renewable energy sold to Missouri consumers as part of the state's renewable energy standard. In addition, the increased use of renewable energy instead of fossil generation provides emission benefits and potential benefits for compliance with U.S. EPA standards.

Q: Please outline your testimony.

A: My testimony will address the need for the project, how it is in the public interest and its' economic feasibility. First, I explain that the Project is needed to deliver low cost wind power to Missouri, and states in MISO and PJM so they can meet state renewable portfolio standards and comply with the US EPA's Clean Power Plan rule (pursuant to section 111(d) of the Clean Air Act). Second, I explain that the GBE Project is in the public interest because: [1] transmission projects such as the GBE Project provide Missouri consumers and PJM consumers with greater access to wind energy resources that lower consumers' wholesale electricity costs; and [2] it lowers Missouri utilities cost of complying with the renewable portfolio standard by providing a larger supply of RECs available for compliance. Finally, I explain that the GBE Project provides access to wind energy that provides current and future environmental benefits.

2. THE GBE PROJECT IS NEEDED TO CONVEY LOW COST WIND ENERGY TO MEET EXISTING STATE AND POTENTIAL FEDERAL REQUIREMENTS

Q: What is your understanding of the purpose of the GBE Project?

A: As explained in the direct testimony of GBE witness Skelly and other Grain Belt Express witnesses, the GBE Project is a 750 mile 600kV direct current transmission line capable of transmitting 3,500 megawatts of electricity -- primarily low cost wind energy -- that could be used by consumers in Missouri, the MidContinent ISO and PJM. A converter station is planned for Ralls County, Missouri that is capable of delivering 500 megawatts ("MW") to Missouri utilities. The primary benefit is that it provides Missouri, MISO and PJM states significantly greater access to underutilized and low-cost wind energy resources in Kansas. [3]

Q: Is there a need for wind energy in Missouri?

A: Missouri has a renewable energy standard ("RES") that increases from 2% in 2011 to 15% by 2021. At least 2% of the overall RES requirement shall come from solar resources. After reviewing the compliance plan reports and compliance plans submitted by Ameren Missouri, Kansas City Power and Light and Kansas City Power and Light -- Greater Missouri Operations, and Empire District Electic Company, I've found that Ameren Missouri is the only one with a need for renewable energy for compliance. It appears that they have a need for approximately 4,000,000 megawatt-hours ("MWh") of non-solar renewable energy RECs, which could be provided by approximately 1,200 MW of wind with a capacity factor of 38%.

---

[3] Direct Testimony of Michael P. Skelly on behalf of Grain Belt Express Clean Line LLC, Exh. ___ at 3-4 and 8 (March 26, 2014).

The Missouri RES also has a retail rate impact test, to keep the cost of RES compliance to 1% of the utilities' cost of an equivalent generation portfolio that uses non-renewable generation. As I will discuss in more detail below, transmission lines such as the GBE Project that allow low-cost wind energy to acess the grid can provide opportunity for Missouri utilties to purchase wind energy that may be at a cost lower than other options available to them.

Q: Is there a need for wind energy in MISO?

A: There are seven states within the MISO footprint that have renewable energy standards that allow for the use of renewable energy from Missouri or from wind energy projects that will interconnect to the GBE project. Meeting the remaining unmet RPS demand in the MISO portions of Illinois (for both ComEd and Ameren Illinois), Minnesota and Wisconsin so they can comply with their state renewable energy standards, will require an incremental addition of wind capacity above their 2013 levels in the range of 4,400 to 6,100 megawatts. See Schedule MG-2.

Q: Is there a need for wind energy in PJM?

A: Since the GBE Project terminates in Indiana with an interconnection into PJM, I have also looked at the renewable energy needs for those states. Most states in PJM allow renewable energy delivered anywhere in the PJM footprint to qualify for compliance with their state RPSs. If we evaluate the non-solar renewable energy needs of DC, Delaware, Maryland, New Jersey and Pennsylvania so they can comply with their state renewable energy standards, they will need an incremental addition of wind capacity above their 2013 levels in the range of 2,800 to 3,750 megawatts. See Schedule MG-2.

Q: What are some key factors that drive the amount of wind energy that is needed?

A: Variables that affect the amount of wind energy actually needed to meet an RPS standard include changes in future load growth, changes in amount of energy efficiency, the capacity factors of future wind deployments, whether some wind projects that are currently under development or under construction proceed to completion and how those RECs are allocated, as well as what percentage of the RPS will be met by wind versus other renewable resources.

Q: Are you aware of wind projects in Kansas that need transmission access in order to come to fruition?

A: There are a couple indicators of interest in the project and potential supply available in Kansas. First, Grain Belt Express issued a request for information ("RFI") to wind generators regarding interest in buying srvice on the GBE Project. News articles state that wind developers with over 13,500 megawatts of planned wind power development in western Kansas responded favorably to the request. In addition, the energy costs of proposed wind projects submitted through the RFI were quite low, in line with wind energy power purchase agreements previously signed in this region.[4]

Another indicator of wind project in western Kansas is the potential supply available. According to the United States Department of Energy's National Renewable Energy Laboratory's ("NREL") wind resource assessment data, Kansas has 952,371 MW of developable wind energy resources. As can be seen in Schedule MG-3, Kansas has some of the

[4] "Grain Belt Express Clean Line Receives Tremendous Response" Kansas Bid Network (January 28, 2014), *available at this web address*: http://www.kansasbids.com/business-news/6745-grain-belt-express-clean-line-receives-tremendous-response.html

best wind resources in the country, with much of the best wind resource located in the part of western Kansas that would be served by GBE.

NREL's data indicate that Kansas has the potential to provide around 9.4% percent of the total onshore wind energy potential in the United States. Kansas's wind resources could provide enough electricity to meet the equivalent of the current electricity needs of the U.S. at least two times over.

Q: Are NREL's wind resource assessments accurate?

A: If anything NREL's assessments are likely to be conservative, as they assume the use of wind turbines with a hub height of 80 meters and do not include the use of new low-wind-speed turbines. Many wind turbines being installed today have hub heights of 100 meters or more, providing them with access to significantly greater wind energy resources, and low-wind-speed turbines are being used in all regions of the country to increase wind power output and reduce cost.[5] In addition, NREL's database assumes that significant amounts of land would be excluded from wind energy development because it is currently used for other purposes.[6] Regardless, the data is clear that Kansas has tremendous wind energy resources that far exceed the electricity needs of both MISO and PJM.

Transmission lines are a major factor that determines how much of the potential wind energy in the Plains states can be utilized by our major load

---

[5]Lawrence Berkeley National Laboratory, 2013 Wind Technologies Market Report, at 30 (August 2014) *available at* http://energy.gov/sites/prod/files/2014/08/f18/2013%20Wind%20Technologies%20Market%20Report_1.pdf.

[6] NREL, Estimates of Windy Land Area and Wind Energy Potential, by State, for areas >=30% Capacity Factor at 80m ("NREL Wind Energy Estimates"), (April 13, 2011). The document can be found at: http://www.windpoweringamerica.gov/docs/wind_potential_80m_30percent.xls.

centers. To capitalize on these wind-rich areas, wind plants need cost-effective access to transmission lines, such as the GBE Project.

Q: Can you quantify the quality of wind resources in these areas?

A: As indicated in schedule MG-3, the quality of the wind resources is high across the region, though it is highest in western Kansas. Importantly, the energy available for wind energy production is proportional to the cube of wind speed, so the difference between the orange and purple areas in the wind speed map in schedule MG-3 is actually quite significant. For example, the 8.5-9 meter/second area of the map, which is the dark purple area that covers significant parts of Kansas, has about 76% more energy available in the wind than the 7.0-7.5 meter/second dark orange area that covers parts of Missouri, Illinois and Indiana and 274% more energy in the wind than the 6.0-6.5 meter/second brown areas that indicate some of the best wind resources available in PJM.

Q: How does this translate to the expected output of wind plants that would be developed in these areas?

A: Capacity factor, defined as the amount of electricity produced by a power plant in a typical year divided by the amount of electricity that that power plant could provide if it ran at 100% of its nameplate capacity for all 8,760 hours in that year, is a commonly used metric for the expected output of wind plants. Capacity factor is strongly related to the average wind speed of an area.

As indicated in the Lawrence Berkeley National Laboratory ("LBNL") data[7] presented in schedule MG-4, in 2013 the average capacity factor for wind projects installed in the "Interior" region in 2012, which as indicated in schedule MG-5 includes Iowa, North and South Dakota, and Minnesota,

---

[7] Lawrence Berkeley National Laboratory, 2013 Wind Technologies Market Report, at 61, Fig. 48.

plus Nebraska, Kansas, Oklahoma, Missouri, Texas, New Mexico, Colorado, Wyoming, and Montana, was 38.1%, versus 34.5% for the "Great Lakes" region that includes Illinois, Wisconsin, Indiana, Ohio, and Michigan. According to this same dataset, the national average wind capacity factor in 2013 for wind projects installed in 2012 was 33.4%.

DOE capacity factor data for existing wind projects in Kansas demonstrate that Kansas has some of the highest capacity factor wind resources in the already stellar Interior region.[8] As shown in schedule MG-6, in 2013 Kansas wind projects had an average capacity factor of 40.1%. These numbers are also likely to underestimate the capacity factors of wind projects that would be built as a result of GBE for several reasons. Several of the wind projects included in this data are 4 or more years old, indicating they were likely built with turbines that tend to have lower capacity factors than those used today. In contrast, future wind projects built for the GBE would likely make use of higher capacity factor turbine designs, including low-wind speed turbines. In addition, some or all of the wind projects in this dataset likely had their capacity factors reduced due to wind curtailment caused by transmission congestion, while the new wind generation developed to utilize GBE would likely not face such curtailment because the GBE line would have eliminated or at least greatly reduced transmission congestion.

In addition, NREL's wind resource database includes estimates of potential wind energy production for each state, in addition to potential installed wind capacity.[9] The potential wind production can be divided by the potential wind capacity to arrive at an estimated average capacity

---

[8] Form EIA-923 detailed data, with 2013 data from EIA-923M and 2012 data from EIA-923, available at http://www.eia.gov/electricity/data/eia923/. Wind project capacity and year online data from AWEA's database of wind projects, available at http://www.awea.org/Resources/Content.aspx?ItemNumber=5728&navItemNumber=5776.

[9] NREL Wind Energy Estimates.

factor for the total wind energy resources in each state. According to that data, the Missouri wind resource has an estimated average capacity factor of 33.7%, while Kansas has a capacity factor of 43.7%.[10] As explained above, these estimates are likely to be conservative because they do not account for recent technological advances and increases in wind turbine height and size.

Q: How does capacity factor affect the economics of wind generation?

A: Capacity factor significantly affects the economics of wind generation. As indicated in schedule MG-7, wind Power Purchase Agreements ("PPAs") prices in the Interior region have averaged around $27 per megawatt-hour ("MWh") over the last three years, versus a figure of $53/MWh for the Great Lakes region and $57/MWh for the Northeast. Based on the smaller subset of wind project PPAs signed in 2013, the Interior region had average PPA prices of $22/MWh. While differences in land and construction costs are a partial factor, the higher capacity factors in the Interior region are almost certainly the major factor for the difference in PPA price between these two regions. As documented in MISO's MVP Report, building wind in a mix of high and low capacity factor regions (See schedule MG-8), relative to building in mostly lower capacity factor regions to be closer to load, achieves the same level of wind energy output with an 11% reduction in the nameplate capacity of wind that must be deployed, with a corresponding 11% reduction in wind energy capital costs.[11]

---

[10] Id.
[11] MVP Report at 66.

Q: Above you mentioned that demand for wind resources in Missouri, MISO and PJM are driven by state's interest in renewable energy. Do you expect that additional regulations are likely to be enacted in the future that will create additional demand?

A: The U.S. EPA is in process of developing a new rule for section 111(d) of the Clean Air Act. Section 111(d) requires the U.S. EPA to regulate emissions that cause or significantly contribute to air pollution that may endanger public health or welfare. On June 2, 2014 the USEPA published a draft rule to reduce the carbon dioxide emissions from existing fossil fuel generation plants to target levels set by the U.S. EPA. A final rule is to be issued by June 1, 2015. States will have one to three years to develop a compliance plan, depending on whether they are developing a plan for their own state or in conjunction with multiple states. The compliance period will run from 2020 to 2030. The draft Clean Power Plan rule specifically allows for the use of renewable energy as a way to comply with the required carbon emission reduction targets. Thus, the GBE line provides access to lower cost wind generation that Missouri could use to comply with the Clean Power Plan. While this line was not planned in anticipation of U.S. EPA requirements, it provides access to low-cost wind power that could be used for compliance.

Q: What is Missouri's carbon reduction requirement under EPA's proposal for 111(d)?

A: EPA proposes that Missouri be required to reduce its emissions rate from 1,963 lbs of CO2/MWh to 1,544 lbs/MWh by 2030, a reduction of 21.3%.[12] In developing the proposed 111d standards for each state, EPA assumed that each of the four "building blocks" would be utilized to bring a state into compliance, and one of those building blocks is the expansion of renewable and nuclear energy. EPA's method assumed Missouri

[12] http://www.c2es.org/federal/executive/epa/carbon-pollution-standards-map

would use 2.8 million MWh of existing and new renewable energy by 2030 to bring the state into compliance,

Under EPA's "alternative" method for establishing the state renewable energy targets that feed into the calculation of the carbon emissions target, EPA assumed that the state could deploy 12.1 million MWh of renewable energy[13] on average for the 2020-2029 compliance period, and maintain that level in 2030 and beyond. That assumption is more than four times greater than the assumed under the proposed renewable energy method, and would cause Missouri's 2030 carbon emission target rate to be the far more aggressive 1,399 lbs/MWh[14], instead of 1,544 lbs/MWh under the proposed method. New wind generation delivered via GBE would help ensure that Missouri can meet that more stringent standard at low cost.

If a state decides not to fully utilize one of those building blocks, that shortfall must be made up by using greater amounts of the other building blocks, exceeding EPA's assessment of what was cost-effective for those other building blocks. Conversely, exceeding EPA's assumption on the amount of renewable energy that would be utilized will reduce the burden and cost of using other compliance mechanisms.

Q: How can wind resources be used to meet the section 111(d) requirements?

A: The draft Clean Power Plan rule allows states to incorporate renewable energy resources into their state implementation plan for purposes of

---

[13] U.S. EPA, Alternative RE Approach Technical Support Document, *which is available at this web address:* http://www2.epa.gov/sites/production/files/2014-06/documents/20140602tsd-alternative-re-approach.pdf

[14] This number is calculated by inputting the 12.1 M MWhs into this EPA model, *available at this web address:* Data File: Goal Computation - Appendix 1 and 2 (XLS)

compliance. The draft rule states the following in outlining one of the ways states could account for the emissions reductions provided by renewable energy:

> We are proposing that RE [renewable energy] and demand-side EE [energy efficiency] measures may be incorporated into a rate-based approach through an adjustment or tradable credit system applied to an EGU's [existing generating units] reported CO2 emission rate. Under such a process, measures that avoid EGU CO2 emission from affected EGUs, such as quantified and verified end-use energy savings and renewable energy generation, could be credited toward a demonstrated CO2 emission rate for EGU compliance purposes or used by the state to administratively adjust the average CO2 emission rate of affected EGUs when demonstrating achievement of the required rate-based emission performance level in a state plan. 79 Fed. Reg. 117 at 34919 (June 18, 2014)

Q: Do you foresee Missouri having a need for wind resources to comply with section 111(d) requirements?

A: The degree of need will be dictated by the state implementation plan that is developed, and Missouri has the flexibility to decide which combination of solutions it will use to comply. However, the GBE Project will make low-cost wind energy readily available for compliance with the Clean Power Plan, enabling Missouri to meet or exceed the level of renewable energy EPA assumed in developing Missouri's target. To the extent Missouri exceeds EPA's assumed level of renewable deployment, that will reduce the burden and cost of using other compliance mechanisms..

Q: Have similar transmission line projects been developed to connect wind resources to areas of large electricity demand?

A: Yes, the Competitive Renewable Energy Zone, or CREZ, lines in Texas were built to connect wind resources to load centers.

Q: Was CREZ effective in interconnecting wind energy resources to areas of large electricity demand?

A: Yes, the CREZ lines were completed earlier this year, and have already experienced overwhelming interest from wind developers who would like to interconnect to the new lines. The most recent ERCOT planning report indicates 8,852 MW of wind projects have signed interconnection agreements, with the vast majority of these interconnections occurring in areas that are newly served by the CREZ lines.[15] In fact, wind developer interest has been so great that ERCOT has already begun to examine further transmission upgrades in the Texas Panhandle region that would allow further wind development to interconnect in that area. As ERCOT notes, "The Panhandle region is currently experiencing significantly more interest from wind generation developers than what was initially planned for the area."[16]

3. THE GBE PROJECT IS IN THE PUBLIC INTEREST BECAUSE TRANSMISSION AND WIND CAN LOWER ELECTRICITY COSTS AND PROVIDES ENVIRONMENTAL BENEFITS

Q: GBE Witness Berry provides a summary of the ways in which the GBE serves the public interest in Missouri. What is your perspective about that summary?

A: I've reviewed the list on page 4 of his direct testimony and I generally agree with his comments, though I intend to address some matters specific to the wind industry. The transmission line and additional wind energy resources that would use that line, in combination, will benefit the

---

15 http://www.ercot.com/content/committees/board/keydocs/2014/ERCOT_Monthly_Operational_Overview_201407.pdf

16 http://www.ercot.com/content/news/presentations/2014/Panhandle%20Renewable%20Energy%20Zone%20Study%20Report.pdf, at page i

public by enabling Missouri, PJM and MISO to meet its electricity needs and state RES at a lower cost than if the line were not built. In addition, the additional wind energy resources will enhance environmental quality in Missouri.

A. Wind And Transmission Lower Consumer Costs In Missouri

Q: GBE Witness finds that the GBE Project will reduce electricity prices. What is your view of his analysis?

A: In his direct testimony, GBE witness Moland calculated the total cost savings and locational marginal price reductions in Missouri in 2019 for four different business scenarios -- Business as Usual, Slow Growth, Robust Economy and Green Economy. I've summarized his findings[17] in the following table:

Scenario	Total Cost Savings ($M)	Reduction in Locational Marginal Price ($/MWh)
Business As Usual	**$22**	**$0.24/MWh**
Slow Growth	**$11**	**$0.12/MWh**
Robust Economy	**$65**	**$0.69/MWh**
Green Economy	**$34**	**$0.34/MWh**

This is generally consistent with savings I've seen in other transmission line cases and in studies I've reviewed regarding the impact wind and transmission have on electricity production costs and prices to ratepayers.

[17] Direct Testimony of Gary Moland on Behalf of Grain Belt Express Clean Line LLC, Exh. ___, sched. M-2 at 2 (March 26, 2014).

Q: What studies have documented the tendency of wind energy to reduce electricity market prices?

A: A European literature review identified a number of studies that have found wind energy tends to drive electricity market prices downward. As that report explains,

> Wind power normally has a low marginal cost (zero fuel costs) and therefore enters near the bottom of the supply curve. Graphically, this shifts the supply curve to the right, resulting in a lower power price, depending on the price elasticity of the power demand.... When wind power reduces the spot power price, it has a significant influence on the price of power for consumers. When the spot price is lowered, this is beneficial to all power consumers, since the reduction in price applies to all electricity traded – not only to electricity generated by wind power. [18]

A recent report by the American Wind Energy Association summarizes 15 studies by state governments, grid operators, and academics that have documented wind energy's role in reducing electricity prices.[19] For example, an analysis in Massachusetts found that the state's renewable initiatives have annual net benefits of $219 million.[20] Finally, a recent analysis in PJM found that doubling the use of wind energy beyond existing RPS requirements would produce net savings for consumers of $6.9 billion per year.[21]

Several analyses by Charles River Associates ("CRA"), International have quantified the value of these broad-based benefits. One study looked at

---

[18] PÖyry, Wind Energy and Electricity Prices, at pages 11 and 12 http://www.ewea.org/fileadmin/ewea_documents/documents/publications/reports/MeritOrder.pdf.
[19] http://awea.files.cms-plus.com/AWEA%20White%20Paper-Consumer%20Benefits%20final.pdf, at page 4
[20] Recent Electricity Market Reforms in Massachusetts: A Report of Benefits and Costs (July 2011), *available at* http://www.mass.gov/eea/docs/doer/publications/electricity-report-jul12-2011.pdf.
[21] Synapse Energy Economics, The Net Benefits of Increased Wind Power in PJM, (May 2013), *available at* http://cleanenergytransmission.org/uploads/EFC%20PJM%20Final%20Report%20May%209%202013.pdf.

an investment in a high-voltage transmission overlay to access wind resources in Kansas, Oklahoma, and Texas. It concluded the transmission investment would provide economic benefits of around $2 billion per year for the region, more than four times the $400-500 million annual cost of the transmission investment.[22] $900 million of these benefits would be in the form of direct consumer savings on their electric bills, with $100 million of these savings coming from the significantly higher efficiency of high-voltage transmission, which would reduce electricity losses by 1,600 gigawatt-hours ("GWh") each year. The remainder would stem from reduced congestion on the grid allowing customers to obtain access to cheaper power.

Similarly, CRA's analysis of the proposed Green Power Express, which would connect 17 gigawatts ("GW") of wind to the grid in the MISO region, found that the transmission plan would yield benefits of $4.4 to $6.5 billion per year for the region (in 2008 dollars), well above the annualized cost of the transmission, estimated to be between $1.2 billion and $1.44 billion.[23] In his FERC affidavit presenting those results, Mr. Stoddard with CRA noted that "I have confirmed with Dr. Shavel that these energy cost savings are widely dispersed through the study Region, but this conclusion is logically necessary: considering the small amount of load located in the upper Great Plains, savings of this order of magnitude could

---

[22] CRA International, First Two Loops of SPP EHV Overlay Transmission Expansion: Analysis of Benefits and Costs (September 26, 2008) *available at* http://www.crai.com/uploadedFiles/RELATING_MATERIALS/Publications/BC/Energy_and_Environment/files/Southwest%20Power%20Pool%20Extra-High-Voltage%20Transmission%20Study.pdf.

[23] FERC Docket ER09-1431, Protest of NextEra Energy Resources, LLC, Iberdrola Renewables, Inc., Mesa Power Group, LLC, Horizon Wind Energy LLC, Enxco, Inc., Acciona Wind Energy USA LLC, GE Energy, Vestas Americas and the National Resources Defense Council. Affidavit of Robert Stoddard, page 4, *available at* http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12111601.

only be realized if the combination of lowered energy prices in the major load centers to the east."[24]

In addition, a May 2012 report by Synapse Energy Economics found that adding 20 to 40 GW of wind energy and the accompanying transmission in the MISO region would reduce the cost of the wholesale electricity needed to serve a typical home by between $63 and $200 per year.[25] As illustrated in schedule MG-9, this report found that electricity market prices decrease drastically as more wind capacity is added to the MISO system. As the report explains, "Since wind energy 'fuel' is free, once built, wind power plants displace fossil-fueled generation and lower the price of marginal supply—thus lowering the energy market clearing price."[26]

Q: Have other utilities noted the consumer benefits of wind energy?

A: Yes, AWEA's report documented a number of quotes from utilities and state regulators confirming the savings wind energy is providing to their ratepayers.[27] Notable examples include statements made when American Electric Power subsidiary Southwestern Electric Power Co. ("SWEPCO") signed long-term power purchase agreements for a total of 358.65 MW from wind projects in Texas, Oklahoma and Kansas. SWEPCO said in a news release that it estimated an average decrease in cost to its customers of about 0.1 cents per kilowatt-hour over a 10-year period starting in 2013.[28]

---

[24] Id.
[25] Synapse Energy Economics, Inc., The Potential Rate Effects of Wind Energy and Transmission in the Midwest ISO Region, at page 3 (May 22, 2012) http://cleanenergytransmission.org/wp-content/uploads/2012/05/Full-Report-The-Potential-Rate-Effects-of-Wind-Energy-and-Transmission-in-the-Midwest-ISO-Region.pdf.
[26] Id.
[27] http://awea.files.cms-plus.com/AWEA%20White%20Paper-Consumer%20Benefits%20final.pdf at page 5

As another example, Oklahoma Gas and Electric estimates that a single wind project will save Arkansas customers $46 million.[29]

As a final example, Alabama Power, a subsidiary of Southern Company, has made several recent wind power purchases. John Kelley, Director of Forecasting and Resource Planning, explained that "These agreements are good for our customers for one very basic reason, and that is, they save our customers money."[30]

Q: Does transmission help to hedge against uncertainty and protect consumer from risk?

A: Yes. Transmission is an important mechanism to protect consumers against unpredictable volatility in the price of fuels used to produce electricity. Transmission can alleviate the negative impact of fuel price fluctuations on consumers by making it possible to buy power from other regions and move it efficiently on the grid. This increased flexibility helps to modulate swings in fuel price, as it makes demand for fuels more responsive to price as utilities are able to respond to price signals by decreasing use an expensive fuel and instead importing cheaper power made from other sources.

Wind generation itself also provides significant hedging value against fuel price fluctuations, so the hedging benefit of transmission is even larger for transmission that connects new wind generation, such as the GBE project. A recent Lawrence Berkeley National Laboratory report concluded that

---

[28] AEP Southwestern Electric Power Company, AEP SWEPCO Signs Wind Power Purchase Agreements for 359 Megawatts, (1/25/2012), *available at* https://www.swepco.com/info/news/ViewRelease.aspx?releaseID=1183

[29] Direct Testimony of Gregory W. Tillman before the Arkansas Public Service Commission, (August 2012), *available at* http://www.apscservices.info/pdf/12/12-067-u_2_1.pdf.

> Comparing the wind PPA sample to the range of long-term gas price projections reveals that even in today's low gas price environment, and with the promise of shale gas having driven down future gas price expectations, wind power can still provide long-term protection against many of the higher-priced natural gas scenarios contemplated by the EIA [United States Energy Information Administration]."[31]

Going forward, a robust transmission grid can provide valuable protection against a variety of uncertainties in the electricity market. Fluctuations in the price of fossil fuels are likely to continue, particularly if the electric sector becomes more reliant on natural gas. Further price risk associated with the potential enactment of environmental policies place a further premium on the flexibility and choice provided by a robust transmission grid. As a result, transmission should be viewed as a valuable hedge against uncertainty and future price fluctuations for all consumers.

Q: How does transmission ensure competitive electricity markets?

A: Transmission infrastructure is also a powerful tool for increasing competition in wholesale power markets and reducing the potential for generators to harm consumers by exercising market power. Just as consumers who have access to one local retailer and lack high-quality roads to easily access stores in other regions would be at the mercy of the prices charged by that retailer, a weak grid makes it possible for generation owners in constrained sections of the grid to exert market power and charge excessive prices. In any market, the more supply options that are available to an area, the less likely it is that any one of those suppliers will be in a position to exert market power.

---

[30] Alabama Power, Alabama Power among leaders in SE in wind power, (October 2012), *available at* http://www.youtube.com/watch?v=6q6Q0_C1SX0 at 2:25.

[31] Lawrence Berkeley National Laboratory, Revisiting the Long-Term Hedge Value of Wind Power in an Era of Low Natural Gas Prices, page i,(March 2013) *available at* http://emp.lbl.gov/sites/all/files/lbnl-6103e.pdf.

In Order 890, FERC explained how transmission constraints can restrict electricity market competition, discussing how those with incumbent generating assets

> can have a disincentive to remedy transmission congestion when doing so reduces the value of their generation or otherwise stimulates new entry or greater competition in their area. For example, a transmission provider does not have an incentive to relieve local congestion that restricts the output of a competing merchant generator if doing so will make the transmission provider's own generation less competitive.[32]

Q: If the GBE Project is approved, what benefits will result to the wind generation industry, and to Missouri and the region?

A: If a certificate of convenience and necessity is granted to the GBE Project I would anticipate that over 3,500 MW of wind generation would be built. Economic development benefits are typically broadly spread around the project area, as indirect economic impacts spread the economic impact beyond local areas and industries that are directly receiving payments. In addition, the manufacturing jobs associated with building the components of the transmission and wind infrastructure would be broadly distributed around the state as well. The Department of Energy's ("DOE") 2008 report, "20% Wind Energy by 2030," found that the manufacturing jobs associated with deploying large amounts of wind would be broadly distributed.[33] As of the end of 2012 approximately 72% of turbines, blades and structures installed in the U.S. in 2011 were from U.S. manufacturers.[34]

---

[32] FERC Order 890 at ¶422, *available at* http://www.ferc.gov/whats-new/comm-meet/2007/021507/E-1.pdf

[33] U.S. Dep't of Energy, 20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply at page 208 (Appendix C) (2008), *available at* http://www.20percentwind.org/ .

[34] AWEA, U.S. Wind Industry Annual Market Report Year Ending 2013, at 53 (2014).

GBE witness Dr. Loomis studied the economic impacts of the wind farms that would be built as a result of the GBE on each state the line passes through and for wind turbine components and materials manufactured in the United States. His estimates of the economic impact on Missouri's supply chain in providing materials and components for approximately 4,000 MW of wind generating facilities built as a result of the line is generally consistent with what I've seen in other transmission line cases.

Q: If a certificate of convenience and need is denied, what would be the negative consequence or results for the wind industry?

A: The benefit of this project is it delivers wind energy from one of the best wind resource locations to the highest need markets for renewable energy -- MISO and PJM. The need for wind energy resources for compliance with RESs or for economic reasons is not as great in and around Kansas, mainly because Kansas has lower electricity demand than states to the east. If a certificate of convenience and necessity is not granted the GBE Project, then the development of 3,500 to 4,000 MW, or potentially even more, of wind resources in western Kansas will likely be lost. I am not aware of other proposed transmission lines that could take the place of serving that prospective wind development, and even if there were the wind development would be additive and not mutually exclusive with that driven by GBE. Therefore, the tens of thousands of jobs, and the billions of dollars of direct project expenditures and millions of dollars of supply chain benefits for Missouri, would be lost.

The bottom line is that the GBE project gives Missouri, and the states in MISO and PJM access to low cost wind energy from Kansas that helps lower their states overall cost of electricity.

B. Transmission Lowers REC Costs For Missouri

Q: What is your understanding of the requirements for a renewable energy credit to be used to satisfy Missouri's RES?

A: Missouri utilities can use RECs that have been generated no longer than three years before the start of the renewable energy requirement in 2011, and can come from wind, solar, crops dedicated for energy production, landfill gas, hydropower, fuel cells and other sources approved by the PSC.[35]

As I mentioned earlier in my testimony, the Missouri RES also has a retail rate impact test that is intended to keep the amount of money spent on the RES to 1% of the utilities cost of an equivalent generation portfolio that uses non-renewable generation.[36] The retail rate impact test acts as a cost cap. If the utilities plan results in a cost that exceeds the 1% limit, then the utility would either change its renewable energy portfolio to use a less costly renewable resource or reduce the amount of renewable energy or RECs it would procure until its costs are within the retail rate impact test.

Q: What is the likely impact of the GBE Project on the cost of complying with the Missouri RES?

A: As I explained previously, the GBE Project is designed to deliver approximately 500 MW of low-cost wind generation from Kansas into Missouri. Because wind energy generated in Kansas can be used to comply with the Missouri RPS, that additional supply will tend to lower the price of renewable energy or RECs that vie for renewable energy contracts.

---

[35] 4 CSR 240-20.100 et seq.
[36] 4 CSR 240-20.100(5).

Increasing the utilities access to low-cost renewable energy or RECs -- as the GBE should do -- keeps the utilities' cost of compliance low, which helps them meet their renewable energy target at the lowest market cost possible at that time. Thus, the low cost renewable energy and RECs that the GBE Project provides to Missouri improves the cost effectiveness of the competitive renewable electricity market.

In addition, wind energy delivered via the GBE Project will be eligible for compliance with RPS requirements in most MISO and PJM states. With the notable exceptions of Ohio, Michigan, and Illinois, most PJM and MISO state RPS's allow renewable energy delivered anywhere within the MISO footprint to qualify for compliance. Therefore, Missouri utilities are competing with utilities from across the MISO and PJM footprints for low cost renewable energy or RECs. As a result, GBE's delivery of large amounts of renewable energy to the converter station in Missouri can be sold in Missouri, Illinois, Wisconsin and Minnesota. And the converter station in Sullivan, Indiana will be connected to the PJM market. As a result, this renewable energy could be used by utilities in PJM and MISO for compliance with their renewable energy standards. Because renewable energy can be delivered across the seam between MISO and PJM, with or without the GBE project in place, REC prices in PJM can affect REC prices in MISO. The additional wind energy delivered by this project would tend to reduce the price of RECs across both the MISO and PJM markets. The savings from lower cost RECs would be passed on directly to Missouri consumers and consumers of those utilities that purchase renewable energy from GBE.

GBE witness Berry estimated the energy cost plus transmission fee for wind energy delivered by the GBE project would be in the range of 3.5 to

4.5 cents per kWh.[37] That is less than the generation weighted average levelized wind power purchase agreement prices for the Great Lakes and Northeast in 2013, which were 5.3 cents per kWh and 5.7 cents per kWh respectively, as indicated in schedule MG-6. Wind energy transferred through the GBE Project could lower their cost of renewable energy.

C. Environmental Benefits

Q: What are some of the environmental benefits the line provides?

A: One benefit of wind is its role in offsetting water consumption by other forms of electricity generation. Wind energy requires virtually zero water to produce electricity, while most conventional forms of electricity generation consume hundreds of gallons of water per MWh produced. The DOE has found that producing 20% of America's electricity from wind energy would conserve 4 trillion gallons of water cumulatively through the year 2030.[38] GBE witness Moland's analysis indicates that the wind enabled by the GBE Project would reduce water consumption across the eastern U.S. by 4.2 billion gallons in 2019.[39] This estimate was based on water consumption rates for various types of generation that would be reduced due to the addition of wind. These water savings would produce broadly spread benefits across the PJM and MISO footprints, because those RTOs would have less demand for electricity from conventional generation plants that rely on water for its production as a result of the delivery of wind energy via the GBE Project. These benefits would be particularly large in an agricultural state like Missouri, and the benefit of reduced costs for producing food and other agricultural products would benefit all consumers.

---

[37] Direct Testimony of David Berry on Behalf of Grain Belt Express Clean Line LLC, Exh. ___ at 17:12-18 (March 26, 2014.

[38] U.S. Dep't of Energy, 20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply at 16 (Executive Summary) (2008), *available at* http://www.20percentwind.org/ .

[39] Direct Testimony of Gary Moland, Exh. ___ at sched. M-2, sht 3 of 3.

In addition, wind energy facilities do not require fuel and as a result have a very low marginal cost of producing electricity. Wind energy output is used by the Independent System Operator's (in this case the Southwest Power Pool) market-based dispatch to displace generation from the generator with the highest marginal cost of production at that time, which is almost always the least efficient fossil-fired power plant. The production and consumption of fossil fuels for electricity generation is a very large source of negative environmental impacts.[40]

GBE witness Moland found that the GBE Project would reduce SO_2 emissions by 19,788 tons in 2019, annual NO_x emissions by 7,111 tons in 2019, and annual CO_2 emissions by 10,013,130 tons in 2019.[41]

These results are consistent with results I obtained using EPA's AVoided Emissions and geneRation Tool (AVERT),[42] which uses empirical power system data and a statistical algorithm to identify which of a region's power plants will have their output displaced by the addition of wind energy. I used the model to calculate the emissions reductions produced by actual 2013 wind production,[43] and found that the average emissions reduction for each MWh of wind energy produced in or physically delivered to AVERT's Lower Midwest region, which includes most of SPP, to be 2.33 lbs of SO_2/MWh of wind, 1.65 lbs of NOx/MWh, and 1,675 lbs of CO_2/MWh. An average MWh of wind produced in or physically delivered to AVERT's Great Lakes/MidAtlantic region, which is roughly

---

[40] National Research Council, Hidden Costs of Energy, (2010), available at http://www.nap.edu/catalog.php?record_id=12794

[41] Direct Testimony of Gary Moland, Exh. ___ at 11:17-19 and sched. M-2 at sht 3 of 3.

[42] AVERT available at http://epa.gov/statelocalclimate/resources/avert/index.html; I used the "Upper Midwest" Regional Data File and modeled the addition of the amount of wind capacity necessary to produce 41 million MWh of wind energy annually.

[43] http://awea.files.cms-plus.com/FileDownloads/pdfs/AWEA_Clean_Air_Benefits_WhitePaper%20Final.pdf

consistent with the PJM region, yields savings of 3.70 lbs of SO_2/MWh, 1.36 lbs of NOx/MWh, and 1545 lbs/MWh of CO_2.

4. ECONOMIC FEASIBILITY

Q: What role does transmission play in enabling the development of wind resources in western Kansas?

A: Transmission is essential, both for allowing wind resources to be developed and enabling already developed wind resources to not have their wind energy output curtailed. In areas where transmission constraints prevent wind energy from being delivered to customers, there is no cost-effective substitute for increasing transmission capacity to alleviate those constraints.

Q: Is it common for transmission development to precede wind development?

A: Yes. AWEA has consistently pointed out that a major difficulty in coordinating wind and transmission development is the mismatch between the relatively short amount of time required to develop a wind project versus the longer time period required to develop a transmission project.[44] Transmission development that pro-actively plans transmission to interconnect areas with high wind resource areas before wind projects have been built has been recognized as an essential aspect of bringing wind to market.[45] Examples include the Competitive Renewable Energy Zone lines in Texas[46] the Priority Projects in SPP,[47] and the Regional

---

[44] American Wind Energy Association and Solar Energy Industries Association ("SEIA"), Green Power Superhighways, (February 2009) *available at* http://www.awea.org/documents/issues/upload/GreenPowerSuperhighways.pdf.

[45] *See generally*, FERC, Order 1000, at ¶¶ 2, 3, 6, 29, 38, 45, *available at* http://www.ferc.gov/whats-new/comm-meet/2011/072111/E-6.pdf.

[46] Electric Reliability Council of Texas ("ERCOT"), Competitive Renewable Energy Zones (CREZ) Transmission Optimization Study, (April 2008), attachment as part of ERCOT filing with the Public

Generator Outlet Study in MISO,[48] which developed the plan for many of the Multi-Value Projects that have been approved by MISO's Board.

Q: Are there other options for delivering these wind energy resources to electricity demand?

A: Not at this time. No transmission projects have been built between SPP and MISO since SPP was created in 2004[49], and as of July of this year there were no other transmission service requests between SPP and MISO.[50] As the PSC is aware, MISO and SPP currently have a case[51] before the Federal Energy Regulatory Commission to revise their inter-regional transmission planning and cost allocation process. SPP's transmission planning policies are currently structured entirely around planning transmission to meet SPP demand, with no consideration for planning lines to meet export demand. That policy would have to change before SPP would likely even begin planning a transmission line to serve export demand, which means it is extremely unlikely any line of that type would enter service this decade.

Transmission is essential if the wind energy resources in Kansas and the Plains states are to be fully utilized in meeting the renewable energy needs of the U.S. As the NREL data in schedule MG-3 indicates, the

---

Utilities Commission of Texas, *available at* http://pbadupws.nrc.gov/docs/ML0914/ML091420467.pdf.

[47] http://www.spp.org/publications/Priority%20Projects%20Phase%20II%20Final%20Report%20-%204-27-10.pdf

[48] MISO, Regional Generation Outlet Study, *available at* https://www.midwestiso.org/Planning/Pages/RegionalGenerationOutletStudy.aspx.

[49] International Transmission Co., Comments of International Transmission Company d/b/a ITC Transmission, Michigan Electric Company, LLC, ITC Midwest LLC and ITC Great Plans, LLC, at 2-3 (July 1, 2014), *filed in* Missouri PSC Docket EW-2014-0156.

[50] Southwest Power Pool, Inc.'s Comments in Response to The Commission's Questions Identified in Its Order Opening an Investigation into Seams, at 15 (July 1, 2014) *filed in* Missouri PSC Docket EW-2014-0156.

[51] Midcontinent Independent System Operator, Inc.'s Compliance Filing for Order No. 1000, Regarding Interregional Transmission Project Coordination and Cost Allocation with Southwest

western Kansas area and the plains states possess wind resources that are many times greater than its electricity demand, so transmission is needed to move the energy from these wind energy resources to load centers elsewhere. Kansas is on the western edge of the Eastern Interconnection, making export west exceedingly difficult, and as I discussed above, opportunities to move that energy eastward to load centers over existing transmission are virtually non-existent. Areas north and south of Kansas also have very large wind energy resources and relatively low electricity demand, so delivering the wind energy from Kansas to those states is not a viable solution. Given the large electricity demand in Missouri, MISO and PJM, building transmission to deliver wind energy resources in western Kansas to consumers in those states is an ideal solution.

Q: Please describe reasons that wind energy in the best regions of SPP is attractive to markets in other regions.

A: Wind resources in many parts of the SPP have the best onshore capacity factors of any resources in the United States. Since higher capacity factors translate to lower electricity costs, access to such renewable resources can reduce the cost of electricity from what it would have been with lower capacity wind resources. In markets such as PJM, access to such resources has the potential to lower consumer costs.

Q: Won't the costs of building transmission to allow access to other markets eliminate the advantage of the lower cost SPP wind resources?

A: As noted above, GBE witness Berry estimated the energy cost plus transmission fee for wind energy delivered by the GBE project would be in

---

Power Pool, Inc., FERC Docket No. ER13-1938-000 (Jul. 10, 2013); Compliance Filing of Southwest Power Pool, Inc., at 21, FERC Docket No. ER13-1937-000 (Jul. 10, 2013).

751 the range of 3.5 to 4.5 cents per kWh[52], which is below the average cost
752 of PPAs signed in the receiving region.
753
754 **Q: Why can't SPP resources be accessed through the existing AC grid?**
755 A: There are several challenges to accessing generation in SPP by those in
756 PJM, including a lack of available transmission capacity. Doing so would
757 require cooperation between several regions that currently does not exist.
758 Further, the cost of crossing SPP, MISO and into PJM would likely be
759 quite large due to rate pancaking of charges, as described below.
760
761 **Q: Please explain.**
762 A: First of all moving power from SPP to PJM requires transmission service
763 across SPP, MISO and PJM. Each of these would require a transmission
764 study which would likely disclose needed transmission upgrades. These
765 costs would likely be added to the cost of service. Each of these studies
766 would be time consuming as they would in many cases be bundled with
767 other requests for transmission service. These studies are notorious for
768 delays and the need for restudy as those requesting service drop out.
769 Each study must be coordinated in each region. It is often difficult to have
770 these studies align in timing. Thus, a study may be tied up in one RTO
771 while the other RTO is requiring the wind developer to commit to the
772 transmission service. Committing to transmission service in one RTO
773 while waiting on approval from other RTOs can place a significant amount
774 of capital at risk.
775
776 The challenges associated with inter-regional transmission planning and
777 cost allocation are a long way from being resolved. FERC acknowledged
778 the need to have regions develop interregional cost allocation and

---

[52] Direct Testimony of David Berry on Behalf of Grain Belt Express Clean Line LLC, Exh. ___ at 17:12-18 (March 26, 2014).

planning in Order 1000. From a practical standpoint, however, a myriad of problems still exist. Interregional filings on cost allocation have not yet been finalized and litigation can be expected to continue. MISO and SPP are currently in litigation before FERC to resolve disagreements on transmission service that make it unclear what obstacles will exist in the cost and need of procuring transmission service in the two regions. Finally, while SPP and MISO are engaged in a joint planning effort they are only examining a business as usual case that does not include an analysis of either regions using wind resources beyond what is called for in the BAU case. There is no ongoing transmission study directly involving PJM, SPP and MISO looking at bringing wind energy into PJM from SPP on AC lines. In the near term the GBE Project is the only realistic option for transmitting wind power from SPP to PJM.

Q: Are there other hurdles that would interfere with access to SPP wind power by PJM?

A: Yes. Transmission service across multiple regions will incur pancaked rates that have significant cost risk for either the generator or end use customer. To deliver electricity from western SPP to PJM there are two main costs -- firm point-to-point transmission and congestion. Firm transmission rates to the SPP/MISO border and from there to the PJM/MISO border are known, however, they are volatile over extended periods of time. For SPP, firm transmission rights have continuously increased since 2005, sometimes dramatically. Since most power purchase agreements for wind are for twenty years, trying to estimate the increase in price of firm transmission rights in two RTOs and still produce a competitive price for your product is extremely difficult. Moreover, there is no mechanism for a generator to hedge its' financial exposure to these costs.

The congestion cost is the difference in price between the wind farm and the SPP/MISO border and from the SPP/MISO border to the MISO/PJM border. This cost can be hedged by utilizing financial transmission rights ("FTRs"), but usually the nameplate capacity of your project cannot be completely hedged via the free allocation of FTRs that comes with a firm transmission path. So a wind generator will be left with some financial risk exposure with regards to both the unhedged portion and the variable cost of purchasing additional FTRs. Further risk related to congestion is knowing what congestion will look like along the route for the twenty year duration of the power purchase agreement. This changes as new transmission lines are built and new generation interconnects to the system. Like firm transmission rights, the ability to properly assess the potential future costs of congestion is extremely difficult to nearly impossible.

In comparison, the GBE Project removes these uncertainties by providing a known cost for transmission capacity for a fixed term. Therefore, a wind generator does not need to worry about changes to the firm transmission right or congestion costs.

Q: Does this conclude your testimony?

A: Yes.

Schedule MG-1

Michael Goggin

Education:

Harvard University class of 2004, B.A.

- Graduated *cum laude* in Social Studies
- Wrote thesis "Is it Time for a Change? Science, Policy, and Climate Change"

Experience:

AWEA Research Director, Senior Electric Industry Analyst February 2008-present

- Provide analytical support and advocacy on transmission and grid integration and issues related to wind energy's impact on markets
- Communicate with the press, the public, and policymakers about wind energy
- Work with AWEA members to develop the organization's policy positions

Sentech, Inc. Research Analyst October 2005-February 2008

- Author white papers, feasibility studies, and economic analyses of solar, wind, geothermal, and energy storage technologies for Department of Energy officials
- Model performance and economics of innovative renewable energy and energy storage technologies
- Research and write fact sheets and presentations for DOE clients
- Provide analytical support for DOE's selection of recipients for renewable energy technology R&D funding

Union of Concerned Scientists Clean Energy Intern May 2005-October 2005

- Worked with the legislative and field staff to promote the inclusion of pro-renewable energy measures in the Energy Policy Act of 2005
- Mobilized clean energy businesspeople and advocates to lobby elected officials
- Prepared fact sheets to support passage of pro-renewable policies

State Public Interest Research Groups Policy Analyst August 2004-May 2005

- Wrote reports advocating pro-renewable energy policies at the state, regional, and federal level
- Gathered and analyzed data to be included in advocacy reports

Publications:

- R. Gramlich and M. Goggin, "The Ability of Current U.S. Electric Industry Structure and Transmission Rules to Accommodate High Wind Energy Penetration," October 2008, presented at 7th International Workshop on Large Scale Integration of Wind Power and on Transmission Networks for Offshore Wind Farms
- M. Milligan, et al., "Impact of Electric Industry Structure on High Wind Penetration Potential," July 2009, NREL Technical Report TP-550-46273
- R. Gramlich and M. Goggin, "What's Next for Wind Power," March 2013, Electricity Journal
- Michael Goggin, "Wind Energy's Emissions Reductions: A Statistical Analysis," July 2013, presented at IEEE PES annual conference

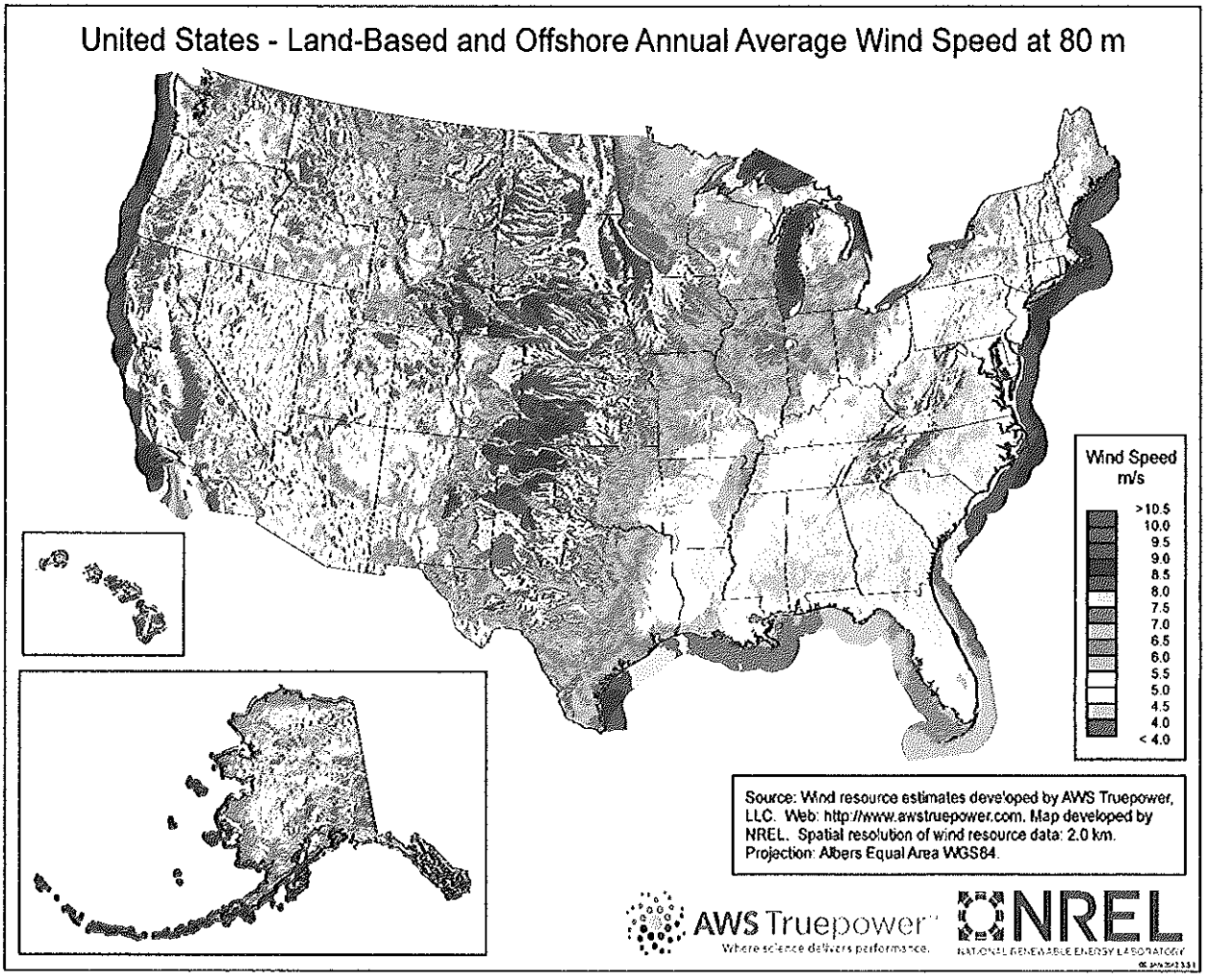
Schedule MG-2

AWEA's Estimates of Incremental Wind Capacity (MW) (beyond what is installed as of the end of 2012) that will be used to meet state RPS requirements in the year 2025, by state

State	Low Estimate	High Estimate
DC	300	400
DE	100	150
IL	3,000	4,000
MD	500	700
MI	500	1,000
MO	1,200	1,800
MN	1,000	1,500
NJ	1,400	1,800
PA	500	700
WI	400	600

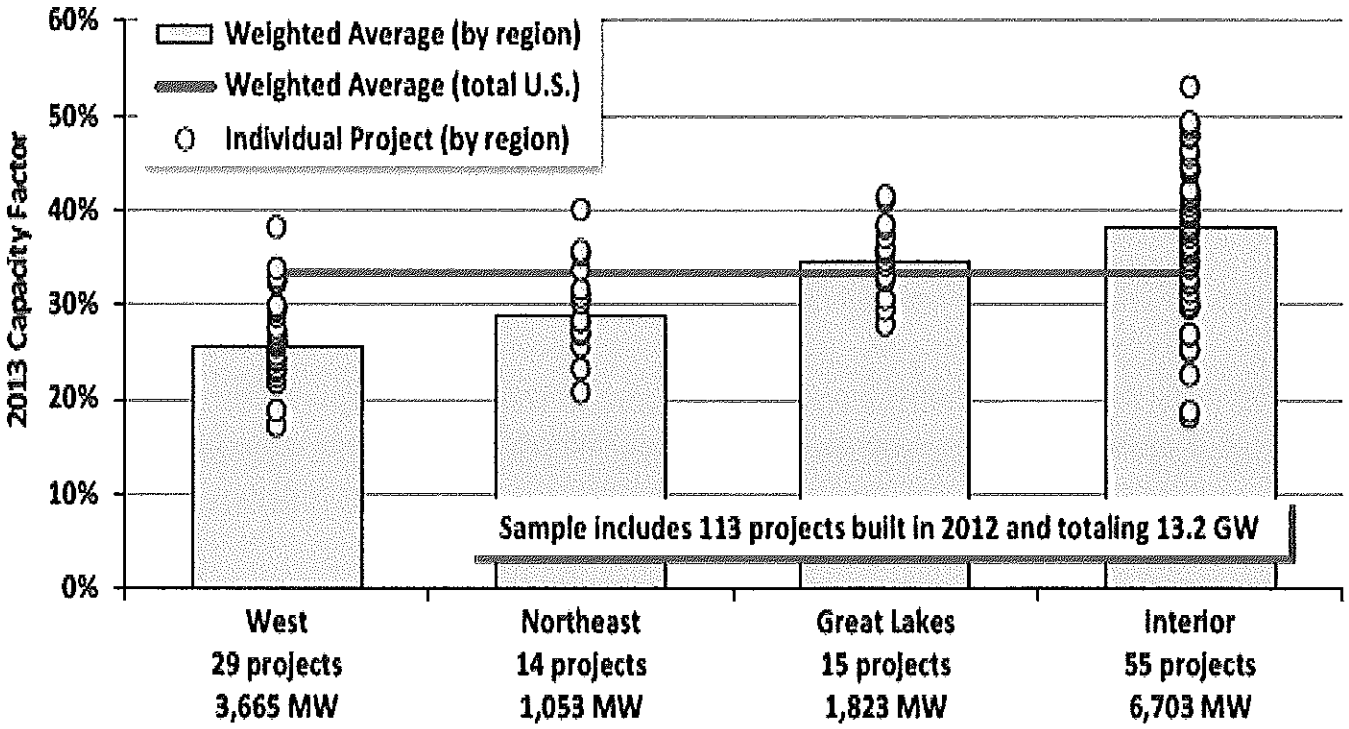
Schedule MG-3

NREL wind resource assessment map of the U.S. as of March 26, 2013, *available at* http://www.nrel.gov/wind/resource_assessment.html, downloaded by Michael S. Goggin.



Schedule MG-4

Capacity factor by region, from Lawrence Berkeley National Laboratories, 2013 Wind Technologies Report, fig. 36 at 45(August 2014), http://energy.gov/sites/prod/files/2014/08/f18/2013%20Wind%20Technologies%20Market%20Report_1.pdf

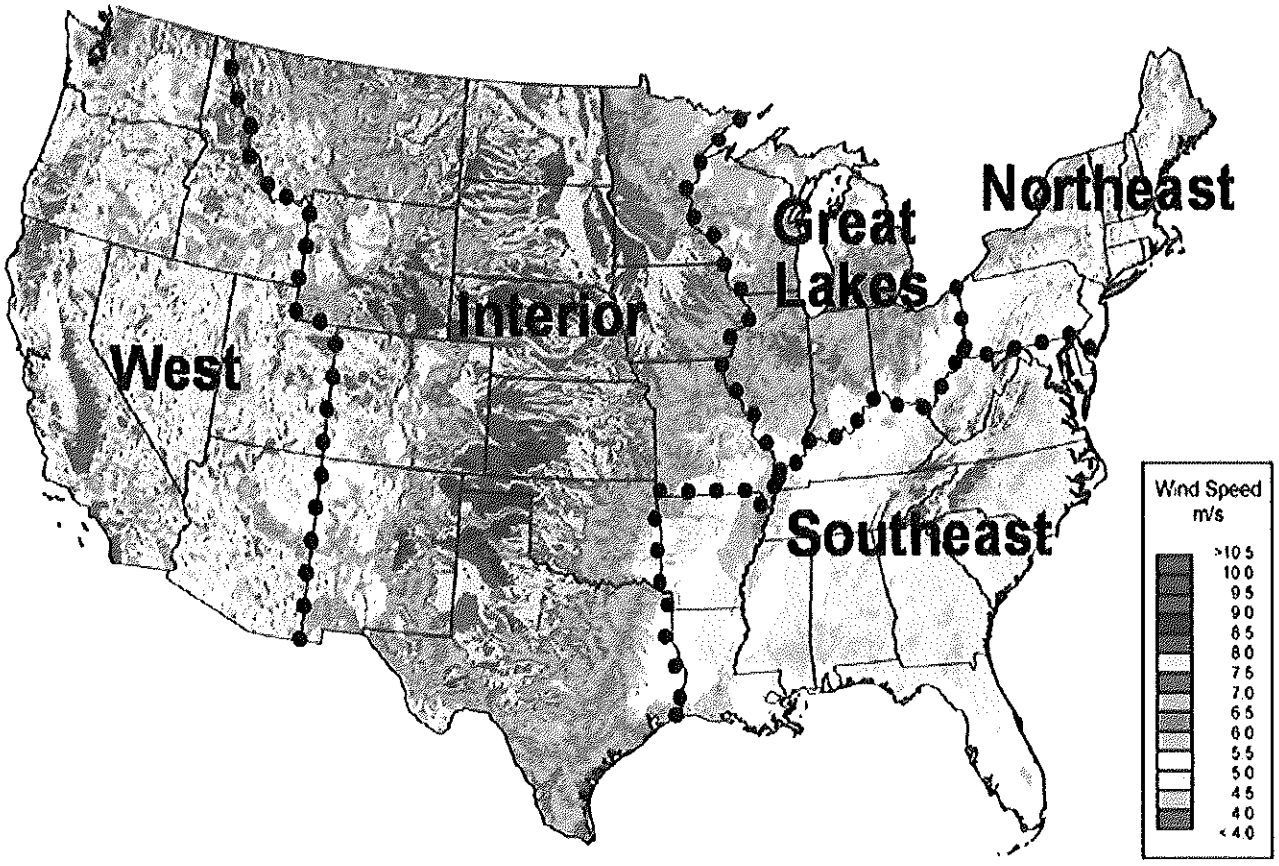


Source: Berkeley Lab

Figure 36. 2013 capacity factors by region: 2012 projects only

Schedule MG-5

Region breakdown overlaid on wind speed map, from *Lawrence Berkeley National Laboratories*, 2013 Wind Technologies Report, at 79 (August 2014) http://eetd.lbl.gov/ea/emp/reports/lbnl-5559e.pdf



Source: AWS Truepower, National Renewable Energy Laboratory

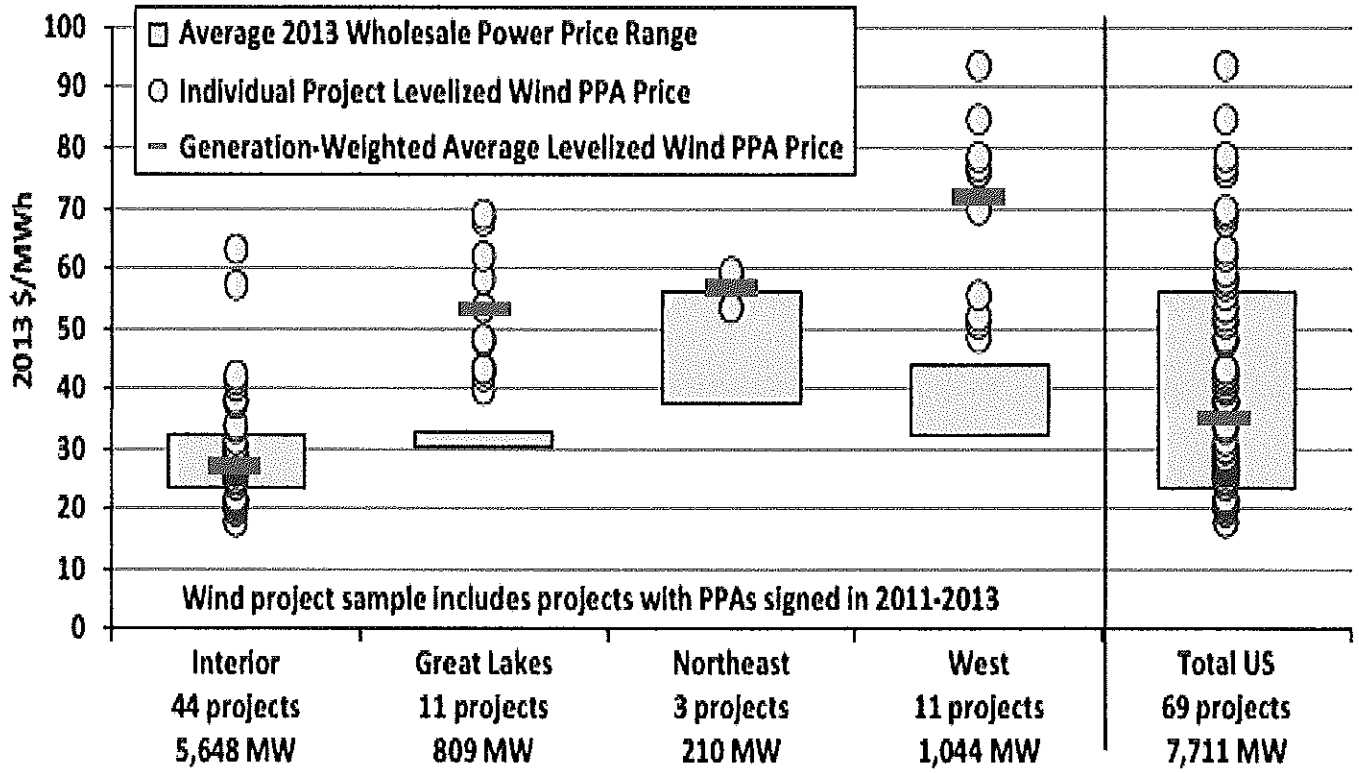
Schedule MG-6

Kansas wind project capacity factor data. Form EIA-923 detailed data, with 2013 data from EIA-923M and 2012 data from EIA-923, available at http://www.eia.gov/electricity/data/eia923/. Wind project capacity and year online data from AWEA's database of wind projects, available at http://www.awea.org/Resources/Content.aspx?ItemNumber=5728&navItemNumber=5776.

Plant Name	Year Online	Project Capacity (MW)	2012 Capacity Factor	2013 Capacity Factor
Gray County Wind Energy	2001	112.2	29.4%	7.2%
Elk River Wind	2005	150.0	43.4%	42.1%
Spearville	2006 + 2010	148.5	31.7%	38.1%
Smoky Hills Wind Project Phase I	2008	100.8	39.8%	42.3%
Cloud County Wind Farm	2010	201.0	33.9%	36.1%
Central Plains Wind Farm	2009	99.0	33.8%	34.8%
Flat Ridge Wind Farm	2009	50.0	32.7%	29.5%
Flat Ridge Wind Energy LLC	2009	50.0	33.7%	31.6%
Smoky Hills Wind Project Phase II	2008	148.5	37.4%	43.0%
Greensburg Wind Farm LLC	2010	12.5	39.8%	NA
Ironwood Wind	2012	84.0		39.7%
Cimarron Windpower II	2012	131.1		44.3%
Post Rock Wind Power Project, LLC	2012	201.0		47.4%
Cimarron Wind Energy LLC	2012	165.6		40.0%
Flat Ridge 2 Wind Energy LLC	2012	470.4		44.9%
Caney River Wind Project	2011	199.8	37.8%	42.3%
Spearville 3 LLC	2012	100.8		38.2%
Shooting Star Wind Project LLC	2012	104.0		42.9%
Ensign Wind LLC	2012	98.9		46.1%
Buffalo Dunes Wind Project	2013	249.8		

Schedule MG-7

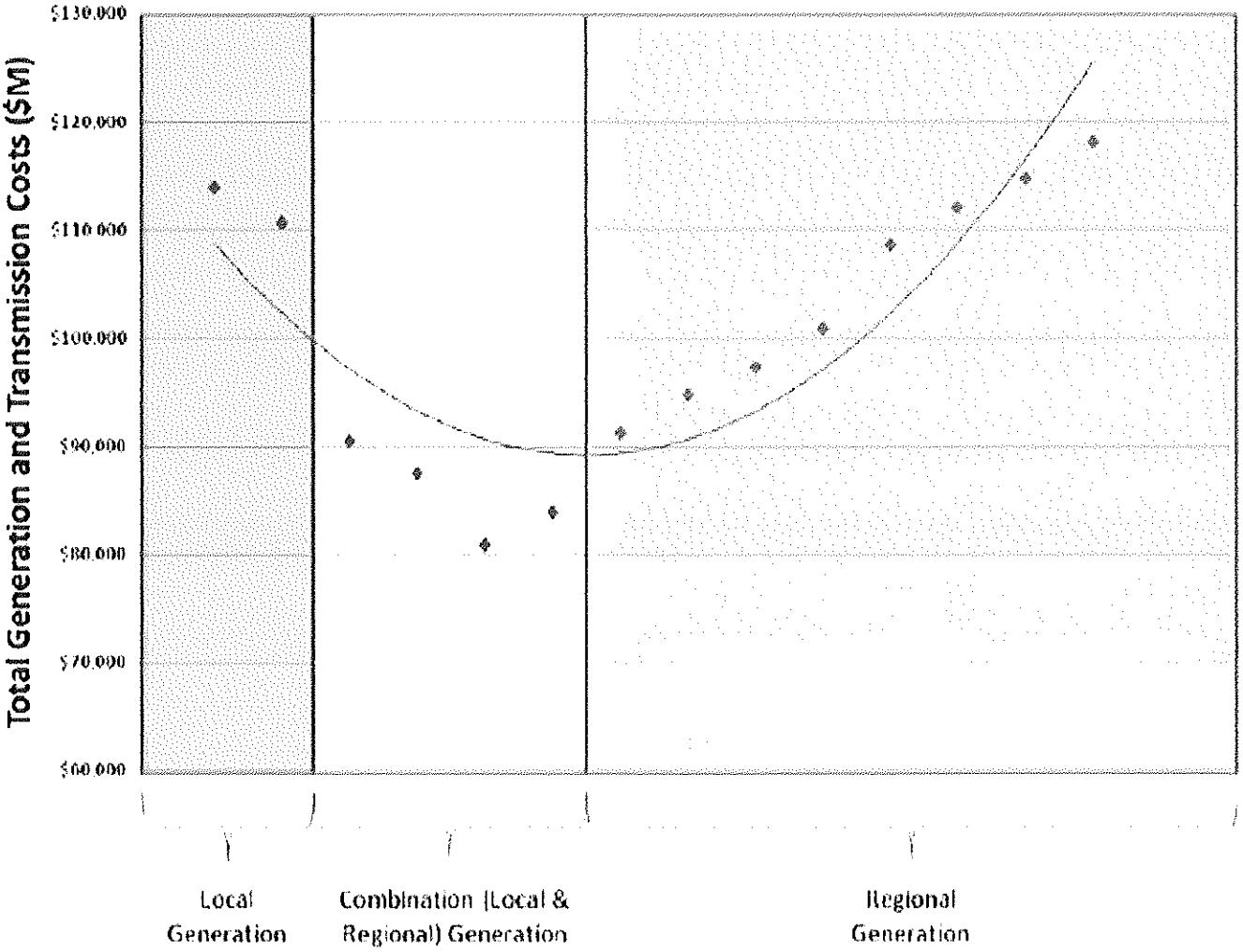
Wind PPA price by region, from Lawrence Berkeley National Laboratories, 2013 Wind Technologies Report, fig. 48 at 60 (August 2014), http://energy.gov/sites/prod/files/2014/08/f18/2013%20Wind%20Technologies%20Market%20Report_1.pdf



Source: Berkeley Lab, Ventyx, IntercontinentalExchange

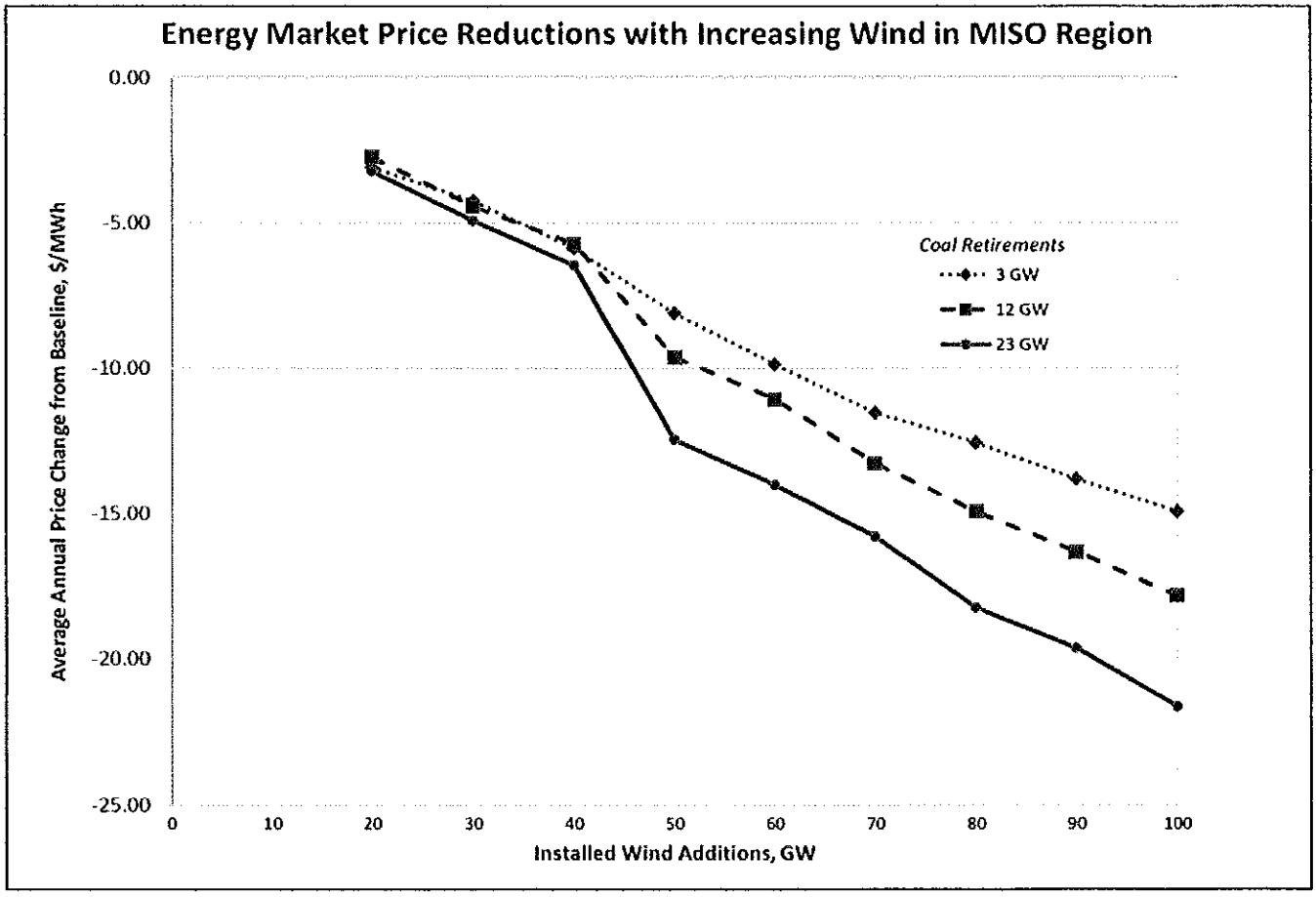
Schedule MG-8

Renewable Generation and Transmission Infrastructure Costs Dependent Generation's Proximity to End User (Local, Regional of Combination); from MISO Multi Value Project Portfolio: Results and Analyses ("MVP Report"), fig. 4.8 at 18 (January 10, 2012)



Schedule MG-9

Electricity Market Prices Decline as Wind Capacity is Added, from *Synapse Energy Economics, Inc.*, The Potential Rate Effects of Wind Energy and Transmission in the Midwest ISO Region, at 4 (May 22, 2012), *available at* http://cleanenergytransmission.org/wp-content/uploads/2012/05/Full-Report-The-Potential-Rate-Effects-of-Wind-Energy-and-Transmission-in-the-Midwest-ISO-Region.pdf.



BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Grain Belt Express Clean Line LLC for a Certificate of Convenience and Necessity Authorizing it to Construct, Own, Control, Manage, Operate and Maintain a High Voltage, Direct Current Transmission Line and an Associated Converter Station Providing an Interconnection on the Maywood 345 kV Transmission Line	)	Case No. EA-2014-0207

AFFIDAVIT OF MICHAEL GOGGIN

I, Michael Goggin, being duly sworn, declare under oath as follows:

1. My name is Michael Goggin. I am the Director of Research for the American Wind Energy Association and my business address is 1501 M Street NW, Suite 1000, Washington, D.C. 20005. I make this affidavit in support of the intervention of Wind on the Wires and The Wind Coalition in the captioned docket before the Missouri Public Service Commission.

2. Attached hereto is my Rebuttal Testimony, labeled as *Rebuttal Testimony of Michael Goggin on Behalf of: Wind on the Wires and The Wind Coalition*, that consists of thirty one pages of questions and answers, a table of contents, a cover page and schedules MG-1 through MG-9.

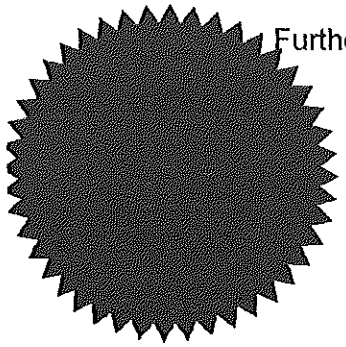
3. The aforementioned documents were prepared by me or under my direction and control.

4. I have personal knowledge of the facts set forth in those documents.

5. If I were asked under oath the same questions posed therein, including my schedules, I would provide the same answers contained therein.

6. The answers provided in the attached testimony, including my schedules, are true and correct to the best of my knowledge and belief.

Further, affiant sayeth naught.



Michael Goggin

Province
~~STATE~~ OF B.C.

District
~~COUNTY~~ OF Squamish

Subscribed and Sworn or Affirmed before me

this 15 day of September 2014.

Notary Public

CAM SHERK, B.A. MALS
NOTARY PUBLIC
P.O. BOX 1760
#201 - 38142 CLEVELAND AVENUE
SQUAMISH, B.C. V8B 0B2
604-567-8711 FAX: 604-567-8910

My Commission expires:

CANADA
PROVINCE OF BRITISH COLUMBIA
PERMANENT COMMISSION

NO ADVICE REQUESTED NOR GIVEN
ATTESTED ONLY BUT NOT DRAWN