**DOCKET NO. 46936**

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| **APPLICATION OF SOUTHWESTERN PUBLIC SERVICE COMPANY FOR: A CERTIFICATE OF CONVENIENCE AND NECESSITY AUTHORIZING CONSTRUCTION AND OPERATION OF WIND GENERATION AND ASSOCIATED FACILITIES IN HALE COUNTY, TEXAS AND ROOSEVELT COUNTY, NEW MEXICO, AND RELATED RATEMAKING PRINCIPLES; AND APPROVAL OF A PURCHASED POWER AGREEMENT TO OBTAIN WIND GENERATED ENERGY** | **§** | **PUBLIC UTILITY COMMISSION OF TEXAS** |

**DIRECT TESTIMONY**
***of***
**WILLIAM P. ZAWACKI**

***on behalf of***

**SOUTHWESTERN PUBLIC SERVICE COMPANY**

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## GLOSSARY OF ACRONYMS AND DEFINED TERMS

| Acronym/Defined Term | Meaning |
|---|---|
| AWEA | American Wind Energy Association |
| MW | Megawatt |
| NSPM | Northern States Power Minnesota, a Minnesota corporation |
| O&M | Operation and Maintenance |
| OEM | Original Equipment Manufacturer |
| Operating Companies | NSPM; Northern States Power Company, a Wisconsin corporation; PSCo; and SPS |
| SPS Wind Projects | 478 MW Hale Wind Project and 522 MW Sagamore Wind Project |
| PSCo | Public Service Company of Colorado, a Colorado corporation |
| SCADA | Supervisory Control and Data Acquisition |
| SMWA | Service Maintenance and Warranty Agreement |
| SPS | Southwestern Public Service Company, a New Mexico corporation |
| UVIG | Utility Variable–Generation Integration Group |
| Vestas | Vestas-American Wind Technology Inc. |
| Xcel Energy | Xcel Energy Inc. |
| XES | Xcel Energy Services Inc. |

**DIRECT TESTIMONY**
**OF**
**WILLIAM P. ZAWACKI**

## I. WITNESS IDENTIFICATION AND QUALIFICATIONS

**Q. Please state your name and business address.**

A. My name is William P. Zawacki. My business address is 1400 Western Avenue, Eau Claire, Wisconsin, 54703.

**Q. On whose behalf are you testifying in this proceeding?**

A. I am filing testimony on behalf of Southwestern Public Service Company, a New Mexico corporation ("SPS") and wholly-owned electric utility subsidiary of Xcel Energy Inc. ("Xcel Energy").

**Q. By whom are you employed and in what position?**

A. I am employed by Xcel Energy Services Inc. ("XES"), the service company subsidiary of Xcel Energy, as Plant Director.

**Q. Please briefly outline your responsibilities as Plant Director.**

A. As Plant Director Regional Generation I am responsible for the overall direct operation and maintenance of the wind, hydro, and bio-mass of Xcel Energy's owned generation. This responsibility includes managing safety, operations, engineering, maintenance, budgeting, licensing, regulatory compliance, and staffing.

**Q. Please describe your educational background.**

A. I have a Bachelor of Science degree in Engineering from the University of Illinois-Chicago, a Master of Science degree in Electrical Engineering from Illinois Institute of Technology, and Master of Business Administration degree

from Cardinal Stritch University. I am a registered Professional Engineer in Wisconsin.

**Q. Please describe your professional experience.**

A. I have over 35 years of experience in the power industry covering engineering, operation, and maintenance in generation, transmission and distribution. I have been focused solely on the generation business since 1999. In 2012, I was given the additional responsibility of Xcel Energy's owned wind plants. During my career, I have held various engineering positions, front line management positions, and higher level management positions.

**Q. Have you testified before any regulatory authorities?**

A. Yes, on one occasion. I submitted pre-filed testimony in support of Public Service Company of Colorado's ("PSCo") application for approval of its Rush Creek Wind Project in Colorado Public Utilities Commission Proceeding No. 16A-00117E.

## II. ASSIGNMENT, TESTIMONY SUMMARY, AND RECOMMENDATIONS

**Q. What are your assignments in this proceeding?**

A. My testimony describes Xcel Energy's[1] operation and maintenance ("O&M") plan for the 478 megawatt ("MW") Hale Wind Project and the 522 MW Sagamore Wind Project (collectively, "SPS Wind Projects"). It also describes the resulting O&M estimates for the SPS Wind Projects and provides a comparison to help demonstrate the reasonableness of the estimates. In particular, my testimony will describe:

1. How Xcel Energy has developed comprehensive O&M capabilities through its experience with five wind farms that Northern States Power Company--Minnesota ("NSPM") owns - totaling 850 MW of wind generation. This experience has led to a staffing strategy and contracting approach that has informed the O&M model that will be applied for the Hale and Sagamore Wind Projects;

2. The significant changes in wind farm O&M over the past 20 years and how Xcel Energy has adapted its O&M model with the changing times in response to advancing and increasingly sophisticated wind technologies;

3. The Service Maintenance and Warranty Agreement ("SMWA") that SPS will enter into with Vestas-American Wind Technology, Inc. ("Vestas"), which will be a key component of O&M plan for the SPS Wind Projects; and

4. The O&M cost estimates Xcel Energy developed for the SPS Wind Projects and a comparison of the O&M cost estimates to other wind projects to illustrate that the projected O&M costs over the estimated life of the SPS Wind Projects are reasonable.

[1] For purposes of this testimony, references to Xcel Energy will include XES and SPS unless the terms are identified separately.

**Q. How does your testimony fit with the testimony of SPS's other witnesses providing direct testimony?**

A. I provide the O&M cost estimates I discuss in my testimony to SPS witness Arthur Freitas, who uses them in his calculation of the revenue requirements for the SPS Wind Projects.

**Q. Please summarize the recommendations and conclusions in your testimony.**

A. O&M activities associated with a wind generation project have evolved significantly from the wind farm operations world of 20 years ago, mainly due to the fundamental changes in system components, and also in data collection, data analysis, and monitoring. Xcel Energy's experience with the O&M of several wind farms in its NSPM region, and in particular a staffing strategy and contracting approach to implement O&M, has led to the development of a prudent O&M model that will be applied for the Hale and Sagamore Wind Projects. A primary component of this O&M model relates to the SMWA that SPS will enter into with Vestas to perform warranty work and three years of scheduled maintenance on the wind turbine generators after final commissioning.

Based on the O&M model and experience with other Xcel Energy wind projects, I provide O&M estimates over the 25-year lives of the Hale and Sagamore Wind Projects. The estimates account for internal and external personnel being assigned exclusively to the SPS Wind Projects, as well as reasonable assumptions about preventative maintenance projects, unexpected maintenance requirements, and other investments that may be necessary to ensure the SPS Wind Projects produce the expected generation over their entire lives. For these reasons, as well as others discussed in my testimony, the estimated O&M costs are reasonable.

## III. WIND O&M AND THE O&M PLAN

**Q. What topic do you discuss in this section of your testimony?**

A. I describe the development of Xcel Energy's O&M capabilities and address the general O&M plan for the SPS Wind Projects, as well as the SMWA. I also discuss how Xcel Energy's O&M experience has evolved and what activities will be undertaken as a part of the O&M for the Hale and Sagamore Wind Projects.

**Q. What is involved in the O&M of a wind project?**

A. O&M activities associated with a wind project generally involve two categories of maintenance: (1) scheduled; and (2) unscheduled. Scheduled maintenance includes general preventative maintenance, while unscheduled maintenance stems from the identification of operational issues from the monitoring of the wind turbines and the subsequent repair of these identified issues.

**Q. Does Xcel Energy have experience with wind farm O&M?**

A. Yes and it continues to gain experience through the five wind farms that NSPM owns. Xcel Energy coordinates and applies the best practices for O&M across all four Xcel Energy Operating Companies.[2] Xcel Energy does so primarily by consolidating activities across company lines through XES as a service company. This structure facilitates Xcel Energy's ability to take what it learns from one operating company and apply it to another. After the completion of the Hale and Sagamore Wind Projects, Xcel Energy utilities will own approximately 2,450 MW of wind resources, all of which require O&M.

[2] Xcel Energy's electric operating companies are: NSPM, Northern States Power Company—Wisconsin, PSCo, and SPS.

The existing wind farms in NSPM, as well as the Rush Creek Wind Project that is currently being constructed by PSCo, are shown in the tables below.[3]

**Table WPZ-1 – NSPM Wind Farms**

| NSP Region Wind Project | Location | Year of Commercial Operation | Nameplate Capacity (MW) | Number of Turbines |
|---|---|---|---|---|
| Grand Meadow | Dexter, MN | 2008 | 100 | 67 |
| Nobles | Worthington, MN | 2010 | 200 | 134 |
| Pleasant Valley | Hayfield, MN | 2015 | 200 | 100 |
| Border Winds | Rolette, ND | 2015 | 150 | 75 |
| Courtenay | Jamestown, ND | 2016 | 200 | 100 |
| **Total** | | | 850 | 476 |

**Table WPZ-2 – PSCo Wind Farm**

| PSCo Region Wind Project | Location | Year of Commercial Operation | Nameplate Capacity (MW) | Number of Turbines |
|---|---|---|---|---|
| Rush Creek | Limon, CO | 2018 | 600 | 300 |
| **Total** | | | 600 | 300 |

[3] Because the Rush Creek Wind Project is currently under construction, the remainder of my testimony focuses on the NSPM wind generation resources and related experience.

## IV. THE EVOLUTION OF WIND O&M

**Q. What topic do you discuss in this section of your testimony?**

A. In this section of my testimony I describe how wind farm O&M has changed over the past 20 to 25 years.

**Q. What are the key areas where wind farm O&M has changed over the past 20 to 25 years?**

A. It is a different world than the wind farm operations world of 20 years ago, mainly due to the fundamental changes in system components, and also in data collection, data analysis, and monitoring. There are two general areas where wind farm O&M has changed significantly over this time period: (1) the development and deployment of centralized data systems; and (2) increases in turbine size. Technological developments have led to fundamental changes in the way the Xcel Energy's wind farm O&M strategies are developed and deployed.

**Q. Please explain the first of the two general areas, the development and deployment of centralized data systems.**

A. Centralized data systems allow Xcel Energy to continuously collect data on key metrics that affect the performance of wind turbines such as vibration and temperature. Today, Supervisory Control and Data Acquisition ("SCADA") systems have been the primary form of centralized data systems deployed at Xcel Energy-owned wind facilities. These systems allow for remote monitoring and control over communication channels. Collecting data on turbine vibration on bearings and gears is an important indicator of negative operational issues with a turbine. It allows early detection of operational issues so more widespread problems do not develop. It also allows the scheduling of work during low wind

periods. Collection of temperature data is also important because it can indicate early component damage. For example, a hot generator bearing can indicate under or over greasing or internal bearing damage. Knowing about these issues early allows Xcel Energy to correct or manage the situation before additional and more costly damage occurs.

Centralized data systems such as SCADA systems have also led to improved monitoring activities. With improved data availability and collection on issues such as vibration and temperature, Xcel Energy has been able to develop trend analyses and identify potential operations issues more quickly. Issues such as vibration can be slow in developing. Accordingly, looking at performance trends and continuous data from turbines can help to identify potential problems early and allows us to react to such problems quickly.

**Q. Please explain the second general area, the increases in turbine size.**

A. Over time, turbines have grown much larger, such as the 2.0 MW turbines being used for the Hale and Sagamore Wind Projects. Land-based turbines have grown taller and rotor diameters have become larger, which allows more wind to be captured. The internal components such as the gearbox and generators have also increased in size, which has allowed for a corresponding increase in power output.

In the last decade, turbine manufacturers have focused on workhorse turbines by refining the previous models to improve reliability and increase power output through improved sub-components, blade designs, and control system upgrades while generally using the same drive train equipment. Increases in turbine size over the years, combined with the increasingly sophisticated

monitoring that has developed over the same timeframe, has refined Xcel Energy's ability to monitor more points on the turbine and identify issues more quickly due to the increased condition monitoring. Moreover, the use of condition-based monitoring systems has increased because it has become more cost effective with the larger MW turbines. This is the case because the same hardware is required to be installed regardless of turbine size.

**Q. How would you characterize the evolution of wind turbine O&M?**

A. O&M monitoring and analysis is more sophisticated than it previously was due to the developments and advancements described above. Further, as wind technologies have matured, there are more robust user groups that have developed to share issues and collaborate to upgrade parts and eliminate future failures. Xcel Energy is an active member of two of these user groups, the American Wind Energy Association ("AWEA"), and the Utility Variable–Generation Integration Group ("UVIG"). The forums these groups provide are a way for industry personnel and other stakeholders to share information on what they are doing to operate and maintain turbines and continue to improve and refine industry best practices regarding wind facility performance and reliability.

## V. DEVELOPMENT OF THE STRATEGY FOR O&M COSTS AT COMPANY-OWNED WIND FACILITIES

**Q. What topic do you discuss in this section of your testimony?**

A. In this section of my testimony I explain that Xcel Energy has an O&M strategy, and how that strategy has been developed. In the next section of my testimony, I apply that strategy to the SPS Wind Projects.

**Q. How has the rapid change in wind farm O&M you described earlier informed Xcel Energy's O&M strategy for the SPS Wind Projects?**

A. Through its maintenance of the wind projects NSPM owns, Xcel Energy has: (1) been at the center of these shifts in O&M for its wind farms; and (2) adjusted strategies for addressing wind farm O&M accordingly. Thus, the rapid changes have generally informed and shaped the O&M strategy in two main areas: (1) the development of Xcel Energy's O&M personnel deployment strategy; and (2) designing the service and maintenance contracting approach.

**Q. How have the changes in O&M affected Xcel Energy's internal O&M staffing strategy?**

A. As O&M technologies have evolved, the Xcel Energy operating companies have simultaneously been adding more utility-owned wind resources. Therefore, the development of internal staffing strategies has been influenced by both O&M technologies and increases in wind resources. As the utility-owned fleet has grown, Xcel Energy has seen significant value in: (1) the use of dedicated internal employees to manage O&M on the wind farms; and (2) being responsible for these O&M activities on a day-to-day basis. In turn, the staff assigned to these respective facilities has grown more sophisticated and internal expertise has

continued to develop as technologies related to O&M have matured, as described earlier in my testimony.

At the wind farms in the NSPM region, Xcel Energy has dedicated teams that are responsible for O&M activities. The activities involved in O&M, including data monitoring and analysis to determine trends and other issues, are a natural extension of the O&M that Xcel Energy has been doing on conventional power plants for years. Therefore, Xcel Energy has developed the model of having dedicated internal staff for O&M as a key part of its broader staffing strategy.

**Q. How do external contractors fit into the staffing model?**

A. Xcel Energy also employs external contractors as part of its staffing strategy for wind farm O&M. Based on the NSPM experience, Xcel Energy found that during the initial phase of wind farm operation, utilizing the original equipment manufacturer ("OEM") (i.e., the turbine manufacturer) to perform these services is effective for several reasons. First, it lowers the risk of claims of inadequate maintenance during the three-year warranty period. Second, it allows Xcel Energy to readily obtain controls and software updates that help to maintain reliability. Examples of controls and software updates include changes to the computer logic and updates to alarm settings. These updates help maintain reliability by clearing out nuisance faults and modifying the computer control logic to allow for improved performance. This approach also allows Xcel Energy internal personnel to work closely with the OEM during this period on process and procedures for maintaining the turbines, which is important because the OEM

teams have the most up-to-date understanding of the latest technological advances, and Xcel Energy can gain greater knowledge of technological changes, which in turn leads to improved O&M on the turbines over their useful life.

Xcel Energy has a second phase of the use of external contractors for wind farm O&M, as well. This phase involves putting the external maintenance contract out to bid after the expiration of the contract with the OEM. This second contract may be with the OEM or with a new third party. It has been Xcel Energy's experience that putting this work up for competitive bidding after the initial service agreement expires reduces O&M costs over the remaining years of the facilities.

**Q. How does Xcel Energy work with the OEM or other third party contractors to provide O&M activities?**

A. Xcel Energy internal staff monitors and coordinates with contractors from the OEM or another third party to perform the O&M for the facility at issue. Xcel Energy coordinates on scheduled maintenance, as well as responding to issues at the site. The OEM or third party contractor bears responsibility for third party reporting at the site, and the third party contractor will typically inform the internal Xcel Energy employees when an operations issue is identified.

In an instance where monitoring of SCADA data or other O&M-related monitoring has revealed a potential operations issue, internal Xcel Energy staff will direct the external contractors to schedule a technician to go out to the turbine in question. Depending upon the nature of the potential problem, the team that goes out to the turbine may include both internal and external personnel. Once at

the turbine, they may insert a camera in the gearbox to see if the camera identifies the problem, or inspect the turbine for wear and tear that is leading to the operations issue. In other circumstances, there may be too much grease and the grease needs to be flushed out or perhaps the auto lubers are not working properly such that an appropriate amount of grease is not being added to the turbine to allow for efficient operation. The point is that, regardless of the issue, Xcel Energy personnel are working hand in hand with the OEM or other third party contractor to address the cause of the issue and fix it as timely as possible.

**Q. How are the wind farms monitored?**

A. Xcel Energy has internal and external staff on site during normal business hours, so if an issue arises during this time we can respond quickly. After hours, the SCADA system is monitored remotely and personnel can be dispatched if an issue arises that requires an immediate response. Turbines can also be turned off remotely if a problem is observed and the turbine needs to be taken offline. Under both emergency and non-emergency situations, however, the O&M response is just like any other power plant: when you get an alarm, you go out there and address it as soon as practicable given the issue.

## VI. THE O&M STRATEGY FOR THE HALE AND SAGAMORE WIND PROJECTS

**Q. What topic do you discuss in this section of your testimony?**

A. In this section of my testimony I describe Xcel Energy's O&M strategy for the Hale and Sagamore Wind Projects.

**Q. Please provide an overview of Xcel Energy's plan for operating and maintaining the SPS Wind Projects.**

A. Xcel Energy's plan for operating and maintaining the Hale and Sagamore Wind Projects is similar to the O&M strategy that has been developed over time with the NSPM wind farms I discussed earlier. Internal personnel will be assigned to the SPS Wind Projects' sites, as well as the SMWA with Vestas that SPS will enter into for a three-year term. Under SMWA, Vestas will provide the external contractor work for three years. After this contract expires, Xcel Energy intends to bid out the third-party contractor work to qualified vendors such as Vestas and others.

**Q. Why is using the O&M strategy deployed for NSPM region projects appropriate for the Hale and Sagamore Wind Projects?**

A. Xcel Energy will be utilizing a proven turbine manufacturer — Vestas. Vestas is an established turbine manufacturer, with more than 48,000 turbines installed across the world. Xcel Energy uses the same turbine technology at the Courtenay Wind Farm, Pleasant Valley Wind Project, and Border Winds Project in the NSPM region. Because of the similarity of turbines, the operating and maintenance for the SPS Wind Projects is expected to be comparable to what Xcel Energy has experienced at the NSPM wind projects.

Based on my experience, and consistent with the approach used for the NSPM wind projects, a two-phased approach of: (1) having dedicated internal staff to oversee and manage the O&M along with the OEM team for the first three years and (2) retaining the OEM or another third party O&M contractor team for the second phase of external O&M contracting constitutes a sound approach to O&M of a wind generation facility.

**Q. What types of expertise do these internal personnel have that is relevant to operating and maintaining the SPS Wind Projects?**

A. The internal staff that will oversee the O&M of the SPS Wind Projects will consist of plant management, engineering, and administrative personnel. I expect that up to six internal personnel, who will be SPS employees, will be engaged in day-to-day operations of the facility. These personnel will have related operational and maintenance experience depending on their area of expertise and assigned duties.

In addition, XES personnel will provide various support services. These support services will include technical service groups for assistance with engineering issues, material and chemical analysis, grid reliability, equipment analysis, safety, and site security.

**Q. Please describe the SMWA that SPS will enter into with Vestas to cover external O&M for the initial three years of the SPS Wind Projects' operation.**

A. The SMWA will be a three-year contract that obligates Vestas to perform warranty work and periodically required scheduled maintenance. In particular, the SMWA will cover warranty work and scheduled maintenance for the towers,

turbines, generators, blades, and associated equipment for the O&M of the wind turbines that will be installed over the term of the agreement. Examples of warranty work include replacement of failed parts such as bearings, electronic components, and the labor associated with the replacement. The SMWA will not cover maintenance of roads, the collector system, or the substations. SPS will separately contract that work out.

I note that whether the SMWA ultimately goes into effect is conditioned on SPS receiving necessary regulatory approvals of both the Hale and Sagamore Wind Projects.

**Q. Why will SPS enter into the SMWA?**

A. As discussed in detail earlier in my testimony, Xcel Energy has good experience by contracting with the original equipment manufacturer for the initial years of wind farm operation then transitioning to the second phase of external contracting after the wind site is up and running for a few years. In addition, end of warranty inspections near the end of the three-year SMWA term are also planned prior to the turbine warranty expiring to ensure any unreported issues or damage are repaired under the terms of the warranty agreement. Therefore, entering into the SMWA will be the best course of action from an O&M standpoint for the first three years of operation of the SPS Wind Projects. This agreement is a part of the broader Turbine Supply Agreement which is described in the testimony of SPS witness Riley Hill.

## VII. ESTIMATED O&M COSTS

**Q. What topic do you discuss in this section of your testimony?**

A. I describe the estimated O&M costs over the 25-year lives of the Hale and Sagamore Wind Projects.

**Q. Please describe the general process used to develop the O&M estimate.**

A. To develop the O&M cost estimate for the SPS Wind Projects, Xcel Energy started with the O&M cost estimates for the Courtenay Wind Farm and Pleasant Valley Wind Project located in North Dakota and Minnesota, respectively. The Courtenay Wind Farm and Pleasant Valley Wind Project estimates were developed based upon key cost factors such as turbine quantity, output, blade length, tower height, and site layout. Since the same base model turbine will be used for the Hale and Sagamore Wind Projects, the estimates were adjusted to account for turbine quantity and size differences. The estimates also factored in staffing needs for wind farm operation.

The Courtenay Wind Farm and Pleasant Valley Wind Project projects are relatively new and, therefore, Xcel Energy does not have a significant period of actual O&M costs to compare the O&M estimates to for the SPS Wind Projects. However, these recent estimates constitute the best available data for purposes of deriving the O&M cost estimates for the SPS Wind Projects.

**Q. Based on your experience, are the O&M estimates for the SPS Wind Projects reasonable?**

A. Yes. First, the O&M costs are consistent with the O&M costs for the NSPM wind projects. A comparison with non-Xcel Energy utilities is more difficult as other

utilities do not share O&M with one another or share this data publicly. Earlier in my testimony, however, I discussed our participation in the AWEA and UVIG user groups. Members of my team had discussions through these groups with other utility personnel that oversee wind farm O&M. My team compared notes on what technologies and general O&M strategies are working or not working to continually make improvements. Based on discussions with my team about these interactions, our O&M estimate is appropriate and reasonable. This conclusion is borne out by the comparative exercise I go through later in my testimony.

**Q. What is the estimated life of the Hale and Sagamore Wind facilities?**

A. Each has an estimated life of 25 years.

**Q. What are the estimated O&M costs over the lives of the SPS Wind Projects?**

A. The estimated O&M costs over the 25-year estimated lives of the SPS Wind Projects are approximately $479 million for the Hale Wind Project and $547 million for the Sagamore Wind Project. The total costs for each project are broken out into nine major categories in Tables WPZ-3 and WPZ-4 (next page).

**Table WPZ-3**
**Total Estimated O&M Expenses Over 25-Year Life for Hale Wind Project**

| Line Item | Cost Category | Amount (Nominal dollars) |
|---|---|---|
| 1 | Company Labor | $15,845,156 |
| 2 | Gen Tie Line Maintenance | $254,380 |
| 3 | Collection System Maintenance | $2,778,613 |
| 4 | Contract Labor | $255,552,091 |
| 5 | Land Leases | $68,245,273 |
| 6 | Materials | $103,258,924 |
| 7 | O&M and Sub Buildings | $1,039,415 |
| 8 | Miscellaneous Expenses | $9,079,500 |
| 9 | Projects | $23,353,906 |
| | **Total** | $479,407,259 |

**Table WPZ 4**

**Total Estimated O&M Expenses Over 25 Year Life for Sagamore Wind Project**

| Line Item | Cost Category | Amount (Nominal dollars) |
|---|---|---|
| 1 | Company Labor | $16,322,095 |
| 2 | Gen Tie Line Maintenance | $40,860 |
| 3 | Collection System Maintenance | $3,187,071 |
| 4 | Contract Labor | $286,130,226 |
| 5 | Land Leases | $88,704,167 |
| 6 | Materials | $115,026,004 |
| 7 | O&M and Sub Buildings | $1,431,941 |
| 8 | Miscellaneous Expenses | $10,184,014 |
| 9 | Projects | $26,050,688 |
| | **Total** | $547,077,066 |

**Q. Please describe the nine categories of O&M costs that are included in the estimates.**

A. Company Labor reflects estimated labor expenses over the lives of the SPS Wind Projects.

Gen Tie Line Maintenance and Collection System Maintenance covers maintenance activities associated with the Gen Tie Lines and Collection System for the SPS Wind Projects. Examples of Gen Tie Line Maintenance activities include: (1) line and vegetation inspections; and (2) minor repairs. Examples of Collection System Maintenance activities include: (1) underground splice, cable, and connection failure repairs; (2) switchgear repairs; and (3) preventive maintenance checks and tests.

Contract Labor includes expected labor expenses under the SMWAs, as well as forecasted external labor costs to conduct O&M activities on the turbines

and transmission line(s). This number includes an estimate of the expected costs of the subsequent O&M services agreement that will be entered into with a third-party contractor (or perhaps Vestas if it provides the best offer) following the expiration of the SMWA.

Land Leases consist of the costs associated with land lease payments over the 25-year estimated lives of the SPS Wind Projects. These costs are discussed in the testimony of SPS witness Hill.

Materials includes costs of materials necessary for O&M such as oils, grease, filters, and small spare mechanical and electrical parts.

O&M and Sub Buildings include costs associated with building utilities such as heating, cooling, water, and janitorial services.

Miscellaneous Expenses include costs such as employee expenses, training costs, office supplies, and safety supplies.

Finally, Projects include costs for activities like leading edge blade repairs, gearbox oil changes, and end of warranty inspections.

**Q. Are the O&M estimates dollars escalated?**

A. Yes. The dollars were totaled and then escalated to account for inflation.

**Q. Do estimated O&M costs vary from year to year?**

A. Yes. The estimated annual O&M cost varies from year to year. The variance in costs from year to year is primarily based on preventive long-term maintenance items.

**Q. Are the O&M costs you have listed the only costs associated with maintaining the project?**

A. No. Capital replacement costs will also be necessary over the lives of the SPS Wind Projects, which have been included in SPS witness Freitas's revenue requirement model.

**Q. Please describe these capital replacement costs for the Hale and Sagamore Wind Projects.**

A. Although preventive maintenance will keep turbines from degrading in the long-term, the projected capital budgets account for the potential failure and replacement of turbine components such as blades, blade bearings, gearboxes and generators. To account for these capital replacement costs, Xcel Energy included $86.7 million for the Hale Wind Project and $96.6 million for the Sagamore Wind Project for their 25-year-lives.

## VIII. O&M COST COMPARISON

**Q. What topic do you discuss in this section of your testimony?**

A. In this section of my testimony I address comparisons Xcel Energy made of the estimated O&M costs for the Hale and Sagamore Wind Projects to other wind projects.

**Q. What information did you review to perform the comparison of the SPS Wind Projects' estimated O&M costs?**

A. I reviewed the August 2016 report from the Lawrence Berkeley National Laboratory within the U.S. Department of Energy, which was also reviewed by SPS witness Hill for purposes of his construction cost comparison and is attached to his testimony as Attachment RH-8. I compared the all-in O&M costs of the Hale and Sagamore Wind Projects to the findings relevant to O&M in this Lawrence Berkeley National Laboratory report.

**Q. What O&M cost figures did you use for the Hale and Sagamore Wind Projects?**

A. One of the analytical metrics that the Lawrence Berkeley National Laboratory report used for O&M was based on capacity-weighted average $/megawatt-hour ("MWh"). Accordingly, I conducted an analysis to come up with a capacity-weighted average $/MWh for the respective SPS Wind Projects. I started with the total estimated O&M expenses over the 25-year life of the SPS Wind Projects of approximately $479 million for the Hale Wind Project and $547 million for the Sagamore Wind Project.

I then took the total modeled production of the Hale and Sagamore Wind Projects over their 25-year-term lives of 51,922,500 MWh and 59,735,000 MWh,

respectively. I arrived at these figures by taking the estimate of SPS witness David Deluca of 2,076,900 MWh/year (Hale) and 2,389,400 MWh/year (Sagamore) of production and multiplying them by 25.

For the final step, I divided the total estimated O&M expenses of $479 million for the Hale Wind Project and $547 million for the Sagamore Wind Project by the total estimated 25-year production of 51,922,500 MWh (Hale) and 59,735,000 MWh (Sagamore). Based on this calculation, I arrived at $9.23/MWh for the Hale Wind Project and $9.16/MWh for the Sagamore Wind Project.

**Q. How does the $9.23/MWh for the Hale Wind Project and $9.16/MWh for the Sagamore Wind Project compare to the O&M related findings in the Lawrence Berkeley National Laboratory report?**

A. First, the report includes a general caveat about the O&M data reviewed, specifically referencing "the scarcity, limited content and varying quality of the data …."[4] Nevertheless, I still believe it is a useful exercise and instructive to compare the estimated SPS Wind Projects' O&M costs to this data set. The report analyzed a sizeable number of wind projects and found that the "capacity-weighted average 2000–2015 O&M costs for the 24 projects in the sample constructed in the 1980s equal $35/MWh, dropping to $24/MWh for the 37 projects installed in the 1990s, to $10/MWh for the 65 projects installed in the 2000s, and to $9/MWh for the 28 projects installed since 2010."[5] The $9.23/MWh for the Hale Wind Project and $9.16/MWh for the Sagamore Wind Project are higher than the $9/MWh average for the most recent set of wind projects analyzed by the Lawrence Berkeley National Laboratory.

[4] Attachment RH-8 at 70.

[5] Attachment RH-8 at 70.

**Q. What conclusions can you draw from this comparative analysis?**

A. First, the fact that our O&M estimate is higher than the Lawrence Berkeley National Laboratory data set should not be misinterpreted. The Lawrence Berkeley Study notes that its O&M cost data is not perfect, as the cited caveat notes above. However, the delta between these two figures illustrates that our O&M estimate is reasonable. SPS has taken an estimation approach with regard to O&M that accounts for internal and external personnel being assigned exclusively to the Hale and Sagamore Wind Projects, and has also made reasonable assumptions about preventative maintenance projects, as well as unexpected maintenance requirements and other investments that may be necessary to ensure that the SPS Wind Projects produce the expected generation over their entire lives.

Although it may seem like an oversimplification, I tend to look at O&M of power plants as being just like upkeep on a car. If you undertake the maintenance necessary and keep it in top flight condition, it will last for a period of time and accommodate a large amount of mileage. SPS will take the same approach for the operation and maintenance of the SPS Wind Projects. Thus, the O&M cost estimates reflects a strategy that will keep the turbines in good condition, while accounting for capital expenses to replace key turbine components as necessary.

For these reasons, the comparison supports a finding that the estimated O&M costs are reasonable.

**Q. Does this conclude your pre-filed direct testimony?**

A. Yes.

**AFFIDAVIT**

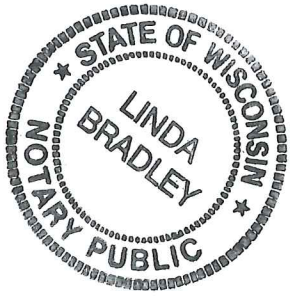
STATE OF WISCONSIN )
)
COUNTY OF EAU CLAIRE )

WILLIAM P. ZAWACKI, first being sworn on his oath, states:

I am the witness identified in the preceding testimony. I have read the testimony and am familiar with its contents. Based upon my personal knowledge, the facts stated in the testimony are true. In addition, in my judgment and based upon my professional experience, the opinions and conclusions stated in the testimony are true, valid, and accurate.

William P. Zawacki
WILLIAM P. ZAWACKI

Subscribed and sworn to before me this 10th day of March, 2017 by WILLIAM P. ZAWACKI.




Linda Bradley
Notary Public, State of Wisconsin
My Commission Expires: April 26, 2019

## CERTIFICATE OF SERVICE

I certify that on March 21, 2017, this instrument was filed with the Public Utility Commission of Texas, and a true and correct copy of it was served by hand delivery on the Staff of the Public Utility Commission of Texas and the Office of Public Utility Counsel, and by hand delivery, next business day courier delivery, or first class mail on each party of record in SPS's most recent base rate case, Docket No. 45524.