

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF SOUTHWESTERN	)	
PUBLIC SERVICE COMPANY’S	)	
APPLICATION REQUESTING:	)	
(1) ISSUANCE OF A CERTIFICATE OF	)	
PUBLIC CONVENIENCE AND NECESSITY	)	
AUTHORIZING CONSTRUCTION AND	)	
OPERATION OF WIND GENERATION AND	)	
ASSOCIATED FACILITIES, AND RELATED	)	CASE NO. 17-00044-UT
RATEMAKING PRINCIPALS INCLUDING	)	
AN ALLOWANCE FOR FUNDS USED	)	
DURING CONSTRUCTION FOR THE WIND	)	
GENERATION AND ASSOCIATED	)	
FACILITIES; AND (2) APPROVAL OF A	)	
PURCHASED POWER AGREEMENT TO	)	
OBTAIN WIND-GENERATED ENERGY.	)	
	)	
SOUTHWESTERN PUBLIC SERVICE	)	
COMPANY,	)	
	)	
APPLICANT.	)	
_____	)	

DIRECT TESTIMONY

of

WILLIAM P. ZAWACKI

on behalf of

SOUTHWESTERN PUBLIC SERVICE COMPANY

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GLOSSARY OF ACRONYMS AND DEFINED TERMS

<u>Acronym/Defined Term</u>	<u>Meaning</u>
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	522 MW Sagamore Wind Project and 478 MW Hale 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.

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of
William P. Zawacki

1 **I. WITNESS IDENTIFICATION AND QUALIFICATIONS**

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

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

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

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

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

10 A. I am employed by Xcel Energy Service Inc. (“XES”), the service company
11 subsidiary of Xcel Energy, as Plant Director.

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

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

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

2 A. I have a Bachelor of Science degree in Engineering from the University of
3 Illinois-Chicago, a Master of Science degree in Electrical Engineering from
4 Illinois Institute of Technology, and Master of Business Administration degree
5 from Cardinal Stritch University. I am a registered Professional Engineer in
6 Wisconsin.

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

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

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

15 A. Yes, on one occasion. I submitted pre-filed testimony in support of Public Service
16 Company of Colorado's ("PSCo") application for approval of its Rush Creek
17 Wind Project in Colorado Public Utilities Commission Proceeding No.
18 16A-00117E.

William P. Zawacki

RECOMMENDATIONS

Q. What are your assignments in this proceeding?

will describe:

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

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

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

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

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

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

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

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

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1 **III. WIND O&M AND THE O&M PLAN**

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

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

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

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

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

14 A. Yes and it continues to gain experience through the five wind farms that NSPM
15 owns. Xcel Energy coordinates and applies the best practices for O&M across all
16 four Xcel Energy Operating Companies.² Xcel Energy does so primarily by
17 consolidating activities across company lines through XES as a service company.

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

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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 Sagamore and Hale Wind Projects, Xcel Energy utilities will own approximately 2,450 MW of wind resources, all of which require O&M.

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.

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1 **IV. THE EVOLUTION OF WIND O&M**

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

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

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

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

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

16 A. Centralized data systems allow Xcel Energy to continuously collect data on key
17 metrics that affect the performance of wind turbines such as vibration and
18 temperature. Today, Supervisory Control and Data Acquisition ("SCADA")
19 systems have been the primary form of centralized data systems deployed at Xcel

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1 Energy-owned wind facilities. These systems allow for remote monitoring and
2 control over communication channels. Collecting data on turbine vibration on
3 bearings and gears is an important indicator of negative operational issues with a
4 turbine. It allows early detection of operational issues so more widespread
5 problems do not develop. It also allows the scheduling of work during low wind
6 periods. Collection of temperature data is also important because it can indicate
7 early component damage. For example, a hot generator bearing can indicate
8 under or over greasing or internal bearing damage. Knowing about these issues
9 early allows Xcel Energy to correct or manage the situation before additional and
10 more costly damage occurs.

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

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

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

7 In the last decade, turbine manufacturers have focused on workhorse
8 turbines by refining the previous models to improve reliability and increase power
9 output through improved sub-components, blade designs, and control system
10 upgrades while generally using the same drive train equipment. Increases in
11 turbine size over the years, combined with the increasingly sophisticated
12 monitoring that has developed over the same timeframe, has refined Xcel
13 Energy's ability to monitor more points on the turbine and identify issues more
14 quickly due to the increased condition monitoring. Moreover, the use of
15 condition-based monitoring systems has increased because it has become more
16 cost effective with the larger MW turbines. This is the case because the same
17 hardware is required to be installed regardless of turbine size.

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

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

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

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

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

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

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

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

17 A. As O&M technologies have evolved, the Xcel Energy operating companies have
18 simultaneously been adding more utility-owned wind resources. Therefore, the
19 development of internal staffing strategies has been influenced by both O&M

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1 technologies and increases in wind resources. As the utility-owned fleet has
2 grown, Xcel Energy has seen significant value in: (1) the use of dedicated internal
3 employees to manage O&M on the wind farms; and (2) being responsible for
4 these O&M activities on a day-to-day basis. In turn, the staff assigned to these
5 respective facilities has grown more sophisticated and internal expertise has
6 continued to develop as technologies related to O&M have matured, as described
7 earlier in my testimony.

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

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

16 A. Xcel Energy also employs external contractors as part of its staffing strategy for
17 wind farm O&M. Based on the NSPM experience, Xcel Energy found that during
18 the initial phase of wind farm operation, utilizing the original equipment
19 manufacturer (“OEM”) (i.e., the turbine manufacturer) to perform these services

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1 is effective for several reasons. First, it lowers the risk of claims of inadequate
2 maintenance during the three-year warranty period. Second, it allows Xcel
3 Energy to readily obtain controls and software updates that help to maintain
4 reliability. Examples of controls and software updates include changes to the
5 computer logic and updates to alarm settings. These updates help maintain
6 reliability by clearing out nuisance faults and modifying the computer control
7 logic to allow for improved performance. This approach also allows Xcel Energy
8 internal personnel to work closely with the OEM during this period on process
9 and procedures for maintaining the turbines, which is important because the OEM
10 teams have the most up-to-date understanding of the latest technological
11 advances, and Xcel Energy can gain greater knowledge of technological changes,
12 which in turn leads to improved O&M on the turbines over their useful life.

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

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

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

9 In an instance where monitoring of SCADA data or other O&M-related
10 monitoring has revealed a potential operations issue, internal Xcel Energy staff
11 will direct the external contractors to schedule a technician to go out to the turbine
12 in question. Depending upon the nature of the potential problem, the team that
13 goes out to the turbine may include both internal and external personnel. Once at
14 the turbine, they may insert a camera in the gearbox to see if the camera identifies
15 the problem, or inspect the turbine for wear and tear that is leading to the
16 operations issue. In other circumstances there may be too much grease and the
17 grease needs to be flushed out or perhaps the auto lubers are not working properly
18 such that an appropriate amount of grease is not being added to the turbine to
19 allow for efficient operation. The point is that, regardless of the issue, Xcel

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1 Energy personnel are working hand in hand with the OEM or other third party
2 contractor to address the cause of the issue and fix it as timely as possible.

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

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

William P. Zawacki

HALE WIND PROJECTS

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

Sagamore and Hale Wind Projects.

maintaining the SPS Wind Projects.

others.

appropriate for the Sagamore and Hale Wind Projects?

an established turbine manufacturer, with more than 48,000 turbines installed

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1 across the world. Xcel Energy uses the same turbine technology at the Courtenay
2 Wind Farm, Pleasant Valley Wind Project, and Border Winds Project in the
3 NSPM region. Because of the similarity of turbines, the operating and
4 maintenance for the SPS Wind Projects is expected to be comparable to what
5 Xcel Energy has experienced at the NSPM wind projects.

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

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

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

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

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

7 A. The SMWA will be a three-year contract that obligates Vestas to perform
8 warranty work and periodically required scheduled maintenance. In particular,
9 the SMWA will cover warranty work and scheduled maintenance for the towers,
10 turbines, generators, blades, and associated equipment for the O&M of the wind
11 turbines that will be installed over the term of the agreement. Examples of
12 warranty work include replacement of failed parts such as bearings, electronic
13 components and the labor associated with the replacement. The SMWA will not
14 cover maintenance of roads, the collector system, or the substations. SPS will
15 separately contract that work out.

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

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

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

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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 Sagamore and Hale 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, SPS 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 Sagamore and Hale 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.

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

3 A. Yes. First, the O&M costs are consistent with the O&M costs for the NSPM wind
4 projects. A comparison with non-Xcel Energy utilities is more difficult as other
5 utilities do not share O&M with one another or share this data publicly. Earlier in
6 my testimony, however, I discussed our participation in the AWEA and UVIG
7 user groups. Members of my team had discussions through these groups with
8 other utility personnel that oversee wind farm O&M. My team compared notes
9 on what technologies and general O&M strategies are working or not working to
10 continually make improvements. Based on discussions with my team about these
11 interactions, our O&M estimate is appropriate and reasonable. This conclusion is
12 borne out by the comparative exercise I go through later in my testimony.

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

14 A. Each has an estimated life of 25 years.

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

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

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Table WPZ-3
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

Table WPZ 4
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

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

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

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

12 Contract Labor includes expected labor expenses under the SMWAs, as
13 well as forecasted external labor costs to conduct O&M activities on the turbines
14 and transmission line(s). This number includes an estimate of the expected costs
15 of the subsequent O&M services agreement that will be entered into with a third-
16 party contractor (or perhaps Vestas if it provides the best offer) following the
17 expiration of the SMWA.

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

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

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

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

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

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

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

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

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

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

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

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

8 A. Although preventive maintenance will keep turbines from degrading in the
9 long-term, the projected capital budgets account for the potential failure and
10 replacement of turbine components such as blades, blade bearings, gearboxes and
11 generators. To account for these capital replacement costs, Xcel Energy included
12 \$96.6 million for the Sagamore Wind Project and \$86.7 million for the Hale Wind
13 Project for their 25-year-lives.

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VIII. O&M COST COMPARISON

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

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

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

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

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

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

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1 approximately \$547 million for the Sagamore Wind Project and \$479 million for
2 the Hale Wind Project.

3 I then took the total modeled production of the Sagamore and Hale Wind
4 Projects over their 25-year-term lives of 59,735,000 MWh and 51,922,500 MWh,
5 respectively. I arrived at these figures by taking the estimate of SPS witness
6 David Deluca of 2,389,400 MWh/year (Sagamore) and 2,076,900 MWh/year
7 (Hale) of production and multiplying them by 25.

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

13 **Q. How does the \$9.16/MWh for the Sagamore Wind Project and the**
14 **\$9.23/MWh for the Hale Wind Project compare to the O&M related findings**
15 **in the Lawrence Berkeley National Laboratory report?**

16 A. First, the report includes a general caveat about the O&M data reviewed,
17 specifically referencing “the scarcity, limited content and varying quality of the
18 data”⁴ Nevertheless, I still believe it is a useful exercise and instructive to

⁴ Attachment RH-8 at 70.

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1 compare the estimated SPS Wind Projects' O&M costs to this data set. The
2 report analyzed a sizeable number of wind projects and found that the "capacity-
3 weighted average 2000–2015 O&M costs for the 24 projects in the sample
4 constructed in the 1980s equal \$35/MWh, dropping to \$24/MWh for the 37
5 projects installed in the 1990s, to \$10/MWh for the 65 projects installed in the
6 2000s, and to \$9/MWh for the 28 projects installed since 2010."⁵ The
7 \$9.16/MWh for the Sagamore Wind Project and the \$9.23/MWh for the Hale
8 Wind Project are higher than the \$9/MWh average for the most recent set of wind
9 projects analyzed by the Lawrence Berkeley National Laboratory.

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

11 A. First, the fact that our O&M estimate is higher than the Lawrence Berkeley
12 National Laboratory data set should not be misinterpreted. The Lawrence
13 Berkeley Study notes that its O&M cost data is not perfect, as the cited caveat
14 notes above. However, the delta between these two figures illustrates that our
15 O&M estimate is reasonable. SPS has taken an estimation approach with regard
16 to O&M that accounts for internal and external personnel being assigned
17 exclusively to the Hale and Sagamore Wind Projects, and has also made
18 reasonable assumptions about preventative maintenance projects, as well as

⁵ Attachment RH-8 at 70.

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1 unexpected maintenance requirements and other investments that may be
2 necessary to ensure that the SPS Wind Projects produce the expected generation
3 over their entire lives.

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

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

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

14 A. Yes.

VERIFICATION

STATE OF WISCONSIN)
) ss.
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

SUBSCRIBED AND SWORN TO before me this 10th day of March 2017.





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