BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF SOUTH DAKOTA

In the Matter of the Complaint by Juhl Energy, Inc. Against Northwestern Corporation DBA Northwestern Energy For Establishing a Purchase Power Agreement	**)**	**Docket No. EL16-021**

TESTIMONY AND EXHIBIT OF KAVITA MAINI ON BEHALF OF THE COMMISSION STAFF

January 10, 2017

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I. INTRODUCTION

Q. Please state your name and occupation.

A. My name is Kavita Maini. I am the principal and sole owner of KM Energy Consulting, LLC.

Q. Please state your business address.

A. My office is located at 961 North Lost Woods Road, Oconomowoc, WI 53066.

Q. Please state your educational and professional background.

A. I am an economist with over 25 years of experience in the energy industry. I graduated from Marquette University, Milwaukee, Wisconsin with Master's Degrees in both Business and in Applied Economics. From 1991 to 1997, I worked for Wisconsin Power and Light Company ("WPL") as a Market Research Analyst and Senior Market Research Analyst. In this capacity, I conducted process and impact evaluations for WPL's Demand Side Management ("DSM") programs. I also conducted forward price curve and asset valuation analysis. From 1997 to 1998, I worked as Senior Analyst at Regional Economic Research, Inc., in San Diego, California, a consulting firm specializing in DSM evaluations and neural network forecasting. From 1998 to 2002, I worked as a Senior Economist at Alliant Energy Integrated Services' Energy Consulting Division. In this role, I was responsible for providing energy consulting services to commercial and industrial customers in the areas of electric and natural gas procurement, contract negotiations, forward price curve analysis, rate design, and on-site generation feasibility analysis.

Since 2002, I have been an independent consultant. I consult in the areas of class cost of service studies, rate design, resource planning, revenue requirement related issues,

Midcontinent Independent System Operator ("MISO") related matters and various policy matters. On behalf of the Wisconsin Industrial Energy Group, I have been an End Use Sector representative at MISO since 2006. I represent the End Use Sector at the Advisory Committee and Planning Advisory Committee (PAC). The PAC is responsible for providing policy guidance to MISO relating to transmission planning. As such, this includes comprehensive vetting related to MISO's use of futures scenarios and input assumptions in its screening and hourly production cost models.

Q. Have you testified before the South Dakota Public Utilities Commission?

A. Yes. I have represented Commission Staff before the South Dakota Public Utilities Commission ("Commission") in various cases associated with evaluating the need for acquisition of generation resources.

Q. Have you participated in utility related proceedings in other jurisdictions?

A. Yes, I have testified before a number of state regulatory commissions, including Wisconsin, Minnesota, Missouri, Iowa and North Dakota. I have also submitted technical comments on a variety of issues related to resource planning, energy policy, cost recovery, revenue allocations and rate design in transmission and renewable rider proceedings. I have also provided technical comments and/or represented the Wisconsin Industrial Energy Group in Federal Energy Regulatory Commission ("FERC") proceedings, several of which have involved MISO-related activities. Exhibit_KM-1 identifies the proceedings in which I have been involved at the state and FERC level.

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

A. I am testifying on behalf of the Commission Staff.

Q. **What is the purpose of your testimony in this proceeding?**

A. My testimony reflects Commission Staff's recommendation regarding the appropriate avoided cost methodology for establishing the pricing terms of three long term purchase power agreements between NorthWestern Energy ("NorthWestern") and Juhl Energy ("Juhl") for Juhl's three wind qualifying facilities ("QF"). The installed capacity of each Juhl QF is 20 MW. Specifically, I address the avoided cost methodology for energy and capacity. I also address the issue of deducting interconnection costs related to network upgrades and wind integration costs.

Q. Please summarize the avoided cost dispute in this complaint.

A. Juhl contends that the modeling analysis conducted by its witness Roger Schiffman, is a sound, reasonable approach to calculating avoided costs for the Juhl Projects. Witness Schiffman calculated a levelized cost of $60.30/MWh for a 20 year term for avoided energy, capacity and carbon costs.[1] Juhl disagrees with the methodology and assumptions used by NorthWestern to calculate avoided energy and capacity costs. Juhl's testimony is silent on the issue of deducting regulation costs. Further, Juhl opposes deducting interconnection costs.

NorthWestern disagrees with Juhl's calculations. NorthWestern contends that Juhl did not use the proper method to calculate avoided costs and failed to account for costs associated with integrating the wind QFs in its portfolio such a regulation and interconnection costs. NorthWestern arrived at an avoided cost calculation (net of regulation and interconnection costs) of $26.86/MWh plus annual capacity payments of

[1] In response to SDPUC 2-32, Juhl's calculations for avoided capacity cost calculations were modified from $1.78/MWh to $1.38/MWh

$42,000/MW-year for accredited capacity as defined by the Southwest Power Pool ("SPP") tariff for the period 2018-2037, the same time period as used by Juhl. Northwestern recommends deducting regulation costs and interconnection costs from the avoided cost payments estimated for the Juhl QFs.

Since the parties could not resolve the differences in avoided cost compensation, Juhl submitted this complaint to the Commission requesting assistance in resolving the dispute.

Q. At the outset, are you going to provide recommendations regarding the avoided cost compensation amount in this testimony?

A. No. My recommendations are focused on the methodology that should be used to calculate the avoided costs. Once the Commission decides when Juhl established a legally enforceable obligation ("LEO"), the compensation amount can be calculated using the methodology approved by this Commission. Commission Staff witness Jon Thurber addresses the establishment of a LEO in his testimony.

II. NORTHWESTERN'S EXISTING SUPPLY AND DEMAND SITUATION

Q. Prior to discussing the issue of avoided costs, please provide a brief description of NorthWestern's existing supply and demand balance.

A. In order to fully address the issue of what NorthWestern may or may not be avoiding in the future, it is instructive to understand the utility's existing supply and demand

situation. NorthWestern's customer mix primarily consists of residential and small business customers. As such, the load is highly correlated with weather and does not consist of energy intensive customers with high off peak use. NorthWestern's minimum load was approximately 107 MW and NorthWestern's average load was approximately 185 MW in 2014 and 2015 respectively. The maximum load for these two years was ~ 306 MW.[2] Given the utility's load profile, NorthWestern seems to have an energy surplus with nameplate baseload coal capacity of 224.1 MW and nameplate wind capacity of approximately 125MW.[3] There are must run provisions for portions of certain generation plants such as Neal 4, Coyote and Big Stone for a total of 81 MW as noted in NorthWestern's witness, Luke Hansen's testimony on Table 1. The must run provisions for the coal units can result in situations where the generation output exceeds load requirements and the excess is sold at market prices that are lower than the variable costs to operate the units.[4] NorthWestern shows a capacity need to fulfill the reserve margin requirements at SPP starting 2019 when a capacity Purchase Power Agreement ("PPA") expires.[5]

The 2014 Integrated Resource Plan ("IRP") describes that the Southwest Power Pool ("SPP") market prices are very competitive and that SPP has a high capacity surplus with a reserve margin of 47%.[6] For example, for the period December 1, 2015 through November 30, 2016, the average day ahead price was $19.53/MWh. As noted in the 2014 IRP, further downward pressure is expected on prices due to an additional 13.8 GW

[2] See Attachment in NorthWestern's response to SDPUC 4-24, Figure 3-5.
[3] NorthWestern also has peaking resources and short term Purchase Power Agreements (see 2014 and 2016 Integrated Resource Plans) provided by NorthWestern in response to SDPUC 1-4 and SDPUC 4-24 respectively.
[4] See NorthWestern's response to SDPUC 6-1.
[5] See NorthWestern's response to SDPUC 1-4, NorthWestern's 2014 Integrated Resource Plan, page 6-4.
[6] See response to SDPUC 1-4, page 4-20.

of wind generation that is under development in the SPP footprint. The 2016 IRP continues to have similar observations about SPP market prices as the 2014 IRP:

> The effects of increased NorthWestern load and lower economic dispatch of thermal units due to depressed market prices leave NorthWestern with a higher level of market purchases than market sales through 2026. [7]

III. AVOIDED COST METHODOLOGY FOR JUHL QFs

Q. What are the concerns raised by Juhl regarding NorthWestern's calculations of avoided costs?

A. Juhl disagrees with NorthWestern's calculation of:

A. Avoided energy costs

B. Avoided capacity costs

C. Calculation of Wind Integration costs

D. Inclusion of Interconnection costs

E. Compensation for avoided carbon costs

My testimony addresses all of these issues except the issue of compensation for avoided carbon costs which is discussed in witness Jon Thurber's testimony.

[7] See NorthWestern's response to SDPUC 4-24 Attachment, page 5-6.

A. AVOIDED ENERGY COSTS

Q. What issues do you address in this section of your testimony?

A. I address concerns raised by Juhl regarding NorthWestern's calculation of avoided energy costs and provide recommendations. I also evaluate NorthWestern's avoided cost energy offer within the context of PPA pricing trends in the wind generation market. Finally, I also provide an alternative compensation approach for Juhl's QF energy output for the Commission's consideration.

Q. Prior to addressing the above mentioned issues, please briefly describe NorthWestern's avoided energy cost methodology.

A. NorthWestern uses a production cost modeling approach to calculate its avoided energy cost. Proprietary modeling software called PowerSimm is used to determine production costs, and PowerSimm is the same software that NorthWestern uses for evaluating its resource planning portfolio decisions. PowerSimm utilizes a stochastic or a probabilistic approach which explicitly captures the uncertainty impact of key inputs. The model uses historical data to capture correlations and fundamental relationships between input variables such weather and load, weather and wind generation, and weather, load, renewable generations and commodity prices. The model runs 100 simulations for each hour over the 20 year period. The relationships between the input variables are then used to probabilistically quantify the variability in simulated future conditions. Generation unit specific detail regarding NorthWestern's portfolio is included in the model.

In order to calculate the avoided energy costs, NorthWestern analyzed three positions with and without the Juhl projects at an hourly level:

- Short position, when NorthWestern is purchasing from the market;
- Long position, when NorthWestern can back down its units and sells to the market economically meaning that the utility's units have been dispatched because the variable costs of producing power are lower than market prices; and
- Minimum generation position when NorthWestern cannot further back down its must-run units and the utility's variable costs of producing power are higher than the market prices.

The three net positions calculated as the difference between with and without Juhl projects, are each summed to a monthly on and off peak level and avoided costs for each of these positions are then calculated external to the model:

- When the net position is short, the avoided cost is calculated by using the relevant on and off peak market price;
- When the net position is long, the avoided costs is calculated by using the relevant on and off peak variable costs of the highest economical dispatch unit; and
- When the net position is minimum generation, the avoided cost is zero.

Q. Please also briefly describe the modeling approach conducted by Juhl.

A. Juhl utilizes a proprietary production cost model called PROMOD, trademarked by Ventyx. PROMOD is an hourly chronological model that uses a deterministic approach. Juhl witness Roger Schiffman uses the reference data from Ventyx to first estimate the SPP market prices. He then uses these prices in modeling NorthWestern system with and

without the Juhl QFs. The difference in total production costs, which includes market sales, is divided by Juhl generation, to derive avoided cost projections. In this approach, Juhl output gets compensated at market prices irrespective of whether NorthWestern's position is short or long.

Q. What are the concerns raised by Juhl regarding NorthWestern's calculations of avoided energy costs?

A. Juhl witness Roger Schiffman asserted that Northwestern's methodology does not result in properly calculating avoided costs and that NorthWestern's model does not capture fundamental changes occurring in the fuel and power markets. He also indicated concerns regarding lack of transparency regarding the model and assumptions used. I evaluate these concerns below.

1. Avoided Cost Modeling Approach

Q. Please explain Mr. Schiffman's concerns about NorthWestern's methodology used to calculate avoided energy costs.

A. Based on a review of Mr. Schiffman's testimony, I understand his concerns to be the following:

- First, he believes that NorthWestern's PowerSimm modeling analysis does not appropriately measure changes in production costs with and without the Juhl wind projects; and

- Second, he does not agree with the application of anything less than market prices to calculate the avoided costs, whether NorthWestern is in a net buy, net sell or net minimum generation position.

a. Production Costs With And Without Juhl QFs

Q. What did Mr. Schiffman's state about NorthWestern's modeling approach with and without the Juhl wind projects.

A. He states the following:

> In NorthWestern's avoided cost approach, while the utility states that it conducted QFIn/QF-Out simulations, it did not use the PowerSimm model to measure changes in production cost with and without the Juhl Energy projects. In contrast, NorthWestern apparently completed PowerSimm simulations with and without Juhl Energy, tabulated results on a monthly basis, and then external to the simulation, applied a combination of forecast monthly energy prices, and/or production cost estimates for its existing generation, or zero to the monthly forecast production of Juhl Energy. NorthWestern limited its use of the PowerSimm model only to estimate whether its system would be in a net purchase or net sale position, on a monthly basis, segmented by High Load (On-Peak) and Low Load (Off-Peak) periods.[8]

In other words, my understanding of his concern is that the analysis is not done on a granular enough level to measure changes in production costs with and without the Juhl projects. He also disagrees with the method used to develop natural gas and electricity price forecasts used in the model.

Q. What was NorthWestern's response to these assertions?

A. NorthWestern's response to SDPUC 4-20 states the following:

[8] See Roger Schiffman's Direct Testimony on page 17.

> NorthWestern simulated the portfolios with the Juhl projects and without the Juhl projects in PowerSimm on an hourly time-step for the 20 year period. The hourly simulation of weather, load, commodity prices, renewable generation, and economic dispatch of NorthWestern's assets allowed for a direct comparison of the two portfolios. The direct comparison of the portfolios detailed, on an hourly basis, the effect of Juhl's production on the net position of NorthWestern's supply portfolio, i.e. whether Juhl produced when NorthWestern was in a net purchase or net sales position. The hourly simulations were summed up to the monthly level and the energy was given a value in the following manner: If Juhl produced during a time when NorthWestern was short generation, Juhl received the average monthly purchase price; if Juhl produced when NorthWestern was long generation and there was a thermal unit that has been economically dispatched, Juhl received the value of the variable cost of the highest dispatchable resource; and if Juhl produced when NorthWestern was long generation and the market price was lower than the variable costs of any dispatchable resource, Juhl energy is valued at zero. PowerSimm is the foundation for NorthWestern's avoided cost calculation.

With respect to the natural gas and electricity forecasts, NorthWestern witness Bleau LaFave states the following:

> Q: Why is the forecast proposed by NorthWestern appropriate to use?
>
> A: NorthWestern's electric price forecast described in Mr. Hansen's testimony consists of two components, real market transactions and EIA's escalation rate forecasts, that are publicly available and represent the most reliable fundamental forecast for NorthWestern Energy's LMP. Using basis adjusted prices from the closest liquid LMP provides short-term future prices that are based on actual transactions. Escalating the observed market prices by the nominal escalation rate published by EIA for market prices for the remaining years represents a solid fundamental industry forecast that is available to the public. This calculation is valid, repeatable, and publicly available. NorthWestern uses this method in the evaluation of all of NorthWestern's planning and portfolio decisions.[9]

Q. Has Powersimm been reviewed by other independent sources?

A. Yes; in NorthWestern's response to SDPUC 4-17, NorthWestern stated that the Montana Public Service Commission hired a consultant, Evergreen Economics to review the

[9] See LaFave Direct Testimony, page 12, lines 11-21.

model. Amongst other tasks, this consultant was tasked with assessing (a) the general capabilities of the PowerSimm model and its internal logic, (b) the reasonableness of the inputs, and (c) completeness and reasonableness of the utility's modeling efforts with respect to accepted best practices for electric utility long-term resource planning.[10] Evergreen Economics generally found the PowerSimm production cost modeling approach including input assumptions to be reasonable.[11]

Q. What is your assessment regarding this matter?

A. First, NorthWestern clarifies that it utilizes hourly data to identify the positions that constitute net purchase or sale. So, contrary to Mr. Schiffman's understanding, this analysis is conducted on an hourly basis.

Second, I tend to agree with Mr. Schiffman that the analysis can be enhanced by using the hourly prices to calculate the avoided costs instead of externally calculating the costs using monthly prices. Since the initial analysis uses hourly pricing data to ascertain the net purchase or sale position, it could be augmented by using the hourly pricing to calculate the costs. That being said, I do not find the current approach unreasonable because NorthWestern is using on and off peak monthly prices and getting more granular over a 20 year long term view should not have a material impact on the avoided cost calculations. Further, as a practical matter, NorthWestern is currently unable to calculate the costs at an hourly level at the present time due to software limitations but is working

[10] See NorthWestern's response to SDPUC 1-7 and related Attachment.
[11] *id*

on modifications.[12] Once the modifications are complete, I would expect NorthWestern to calculate the avoided costs on an hourly level.

Third, with respect to the natural and electricity price forecasts, NorthWestern's approach of using near term price expectations with long term escalations using publicly available data from the Energy Information Administration's ("EIA") Annual Energy Outlook is reasonable. In this regard, I support NorthWestern's perspective provided in its response to SDPUC 1-5 (a) and (b) that the historical information used to develop the correlations and shapes in the model incorporate historical fundamentals, the near term forward curve provides expectations in the near term and the use of the long term nominal natural gas price growth rate is a reasonable proxy for future market dynamics.[13] Further, NorthWestern uses the same approach for its own resource planning and is not discriminating against Juhl Energy. In addition, I would also note that Evergreen Economics found this forecasting approach to be generally reasonable

Q. What is a core advantage of using PowerSimm?

A. PowerSimm captures uncertainty in key inputs as well as simulates the dynamic nature of the interactions between weather and load, weather and intermittent generation and weather, load, intermittent generation and pricing. Given the variability of these inputs, I believe that capturing uncertainty is an important advantage of the model compared to other deterministic models which do not account for this uncertainty.

Q. Is Juhl critical of these statistical relationships?

[12] See response to SDPUC 6-4.
[13] See also NorthWestern's response to SDPUC 1-15

Mr. Schiffman is critical about this advantage asserting that the statistical relationships are only valid if the underlying processes that are being modeled remain stable and unchanging. He indicates that the processes are undergoing structural change and therefore, the statistical relationships are invalid and inaccurate. He points to various factors such as environmental factors, advent of shale gas and increased intermitted resources as reasons for increased demand and prices for natural gas, which will further increase the correlation between natural gas and electricity prices in SPP and will also alter the statistical relationships.

Q. What is your response to his assessment?

A. In my opinion, NorthWestern is implicitly capturing the impacts of these changes by using the EIA long term nominal natural gas prices growth rate. The EIA does consider these factors in conducting its macroeconomic analysis. [14] Further, there are certain fundamental relationships that will likely not change materially for the foreseeable future such as load and weather, intermittent resources and weather. To the degree that there are material changes in statistical relationships in the future, these will be captured over time in the historical data used to formulate the probability distributions. Since load and wind generation, for example, respond to weather conditions, it is valid to recognize the uncertainty and the interaction of these variables instead of ignoring them.

[14] See http://www.eia.gov/outlooks/archive/aeo15/index.cfm

Further, by increasing the electricity prices using EIA's nominal natural gas growth rate, NorthWestern is also accounting for the high correlation between natural gas and electricity prices.

Aside from capturing short and long term expectations, NorthWestern's approach relies, in large part, on historical relationships to predict future conditions, while Juhl's methodology uses the expected supply and demand fundamentals behavior to do the same. Unlike the future, the historical relationships are by their nature, observable and not speculative. Future scenarios, on the other hand, while modeled using sound economic supply and demand fundamentals, have a degree of speculation regarding what will occur going forward with respect to generation retirements, siting decisions, demand and supply of natural gas etc. To the degree, these speculations do not materialize, the underlying assumptions are also not valid. For example, the latest changes at the presidential level add more uncertainty regarding the impact of environmental regulations on generation retirements, generation additions and prices in the future. Thus, in my opinion, relying on historical relationships is not an unreasonable way of predicting the future as it limits speculation.

Q. Does Juhl's modeling analysis pose concerns?

A. Yes. The model is deterministic and does not account for uncertainty in input variables. Load growth likely assumes normal weather throughout the 20 year term. Considering the growing penetration of renewable generation, the model lacks the ability to account for uncertainty in weather and the related impacts on renewable generation, load, and prices, which analysts generally manage by doing mid, low, and high cases.

The model also assumes economic dispatch for all of the MWs of NorthWestern's generation as noted in Juhl's response to NorthWestern's data request 1-41. In reality, as noted on NorthWestern's witness Luke Hansen's testimony, NorthWestern has MWs of generation that are designated as must run as per agreements with co-owners, meaning they are essentially a price taker. Utilities normally have such designations for certain plants where it is inefficient or impractical to switch them on or off in response to pricing. As discussed later in this testimony, the issue of minimum generation situations are concerning given NorthWestern's load profile and generation mix.

Mr. Schiffman asserts that the PROMOD model is widely used in the industry and is an independent forecast. However, this model utilizes a large topology to estimate prices and it would be challenging if not impossible to thoroughly vet and ascertain the reasonability of all of the assumptions used.

Q. Of the two models, PROMOD and PowerSimm, which one do you recommend?

A. I recommend PowerSimm because this model is used by NorthWestern for the evaluation of NorthWestern's resource planning and portfolio decisions. The utility is not discriminating against Juhl's QF because it is being consistent in using the same model and related input assumptions as utilized in its resource planning. Further, as discussed earlier, I find NorthWestern's modeling approach to be generally reasonable and consider PowerSimm's stochastic modeling ability to capture uncertainty across a range of key inputs, to be superior than PROMOD's deterministic approach.

Q. What is your overall perspective regarding long range avoided cost forecasting?

A. As a practical matter, it is important to not lose sight of the fact that the forecast is being conducted over a 20 year period. So, irrespective of which model is used, the analysis inherently requires making assumptions regarding a whole host of inputs. No model is perfect and to my knowledge, there is nothing in PURPA which states that a specific model should be used to calculate long term avoided costs. The more important issues to focus on and ascertain are: (a) whether the utility's modeling analysis reasonably estimates avoided costs, (b) whether the utility is discriminating against a QF by applying a method different than how it evaluates the acquisition of future resources in its own planning, and (c) whether the utility is ensuring that the method used does not result in the unintended consequences of adversely impacting NorthWestern's retail customers. These points are consistent with PURPA.[15] As I discuss in more detail below, NorthWestern's approach to calculating the long term energy avoided costs are consistent with PURPA provisions.

b. Compensation For Short And Long Positions At Market Price

Q. Please explain Mr. Schiffman's second area of disagreement that purchases and sales should be compensated at the market price.

A. Mr. Schiffman explains on page 36 of his testimony that in his modeling analysis:

> During hours when the NorthWestern system requires additional energy, the simulation assigns incremental costs for that energy based on forecast SPP market prices. During hours when the NorthWestern system is long on energy, the simulation allows the excess to be sold into the SPP market based again on forecast hourly SPP market prices. This is common and industry accepted best practice for completing power market simulations.

[15] See § 292.304 Rates for purchases

> It is also how NorthWestern operates, or should operate its power system on a daily basis.

Thus, he disagrees with NorthWestern's approach that in hours when NorthWestern is in excess sales position and the units can be backed down, the avoided cost is the variable cost of NorthWestern's most expensive unit and that when NorthWestern is in excess sales position and the units cannot be further backed down, the avoided cost is zero.

Q. What is NorthWestern's position regarding this matter?

A. NorthWestern witness Bleau LaFave's overall position is what a utility can actually avoid by purchasing the QFs output determine the price paid to the QFs. NorthWestern simulates three net dispatch conditions as noted in his testimony:

> For each hour of the forecast, three dispatch conditions result from this economic dispatch.
> 1. The portfolio is short energy and is purchasing from the market,
> 2. The portfolio is long energy and assets in the portfolio have been dispatched and can be backed down, or
> 3. The portfolio is long energy and no assets in the portfolio can be backed down.[16]

Under the dispatch condition when the portfolio is:

1. Short energy ("Short Position"), the avoided cost is market prices;
2. Long energy and portfolio can be backed down ("Long Position"), the avoided cost is the variable costs of the dispatchable resource with the highest variable costs; and
3. Long energy and no assets in the portfolio can be backed down further ("MinGen Position"), the avoided cost is zero.

[16] See Bleau LaFave's Direct Testimony, page 11, lines 13-19.

With respect to the third dispatch situation, MinGen Position, witness Bleau LaFave asserts the following:

> In this situation, NorthWestern cannot avoid any cost by purchasing from the QF. NorthWestern cannot avoid market purchases; there are none. NorthWestern cannot avoid the variable cost of its owned-generation. Market prices are lower than the variable cost of the owned-generation. NorthWestern customers receive the benefit of any sales to the market when NorthWestern is long generation. If NorthWestern pays a fixed estimated market price to the QF, NorthWestern's customers are paying more than they would otherwise.[17]

Q. How do you respond?

A. I support NorthWestern's position regarding this matter for several reasons:

First, in a Short Position, the utility avoids procuring from the market and therefore, the appropriate compensation is the market price.

Second, in a Long Position, the Juhl QFs output avoids NorthWestern's variable costs of the economically dispatchable resource with the highest variable costs and that is the appropriate compensation.

Third, in a MinGen Position, NorthWestern does not avoid any costs. Rather, costs are incurred because on average, the variable costs of the must run resources are higher than the market prices. Table 1 below shows that from a historical perspective, there are some months in particular (such as February 2016 - May 2016) where the minimum generation situation is 25%-54% of the time.[18] Further, note that the average variable costs of the least cost resources are significantly higher than the average market prices in each of the

[17] See Bleau LaFave Direct Testimony, page 13, lines 5-11.

[18] See NorthWestern's response to SDPUC 6-1.

months and in certain months, double or triple the average market price. During such hours, it is costing the utility more to keep the units running at minimum generation than the market prices. Consequently, the utility does not avoid any costs and it is not appropriate to compensate the QF during such situations.

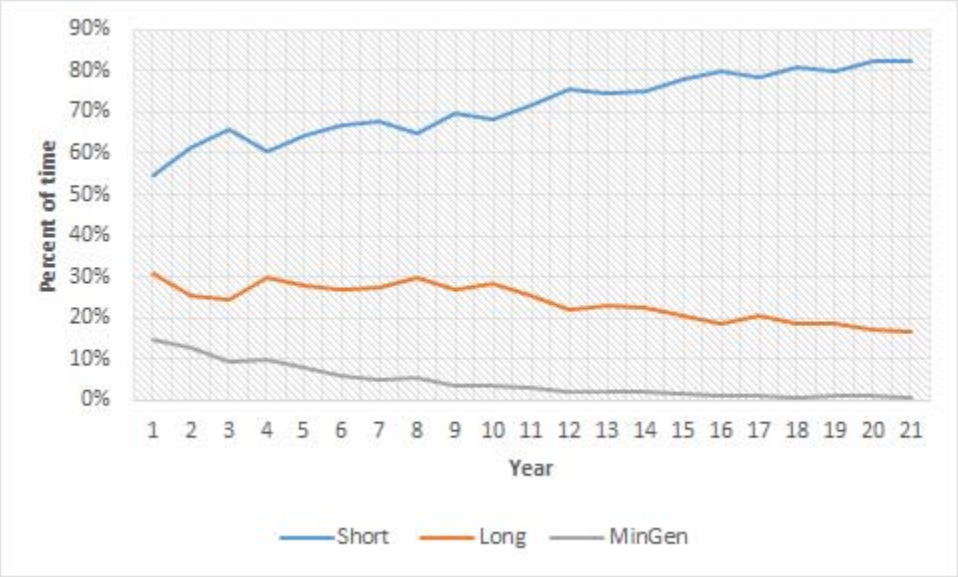
Table 1: Monthly Historical Data Regarding Minimum Generation Since Joining SPP

Month	Number of Hours in Month	Number of Hours at Min Generation	% of Hours at Min Generation	Average Price when at Min Generation	Average Variable Cost of Least Cost Resource during Min Generation Hours
Oct-15	744	28	4%	$ 12.28	$ 20.06
Nov-15	721	56	8%	$ 8.89	$ 20.12
Dec-15	744	117	16%	$ 9.89	$ 19.74
Jan-16	744	53	7%	$ 8.74	$ 19.44
Feb-16	696	175	25%	$ 4.70	$ 19.43
Mar-16	743	290	39%	$ 8.16	$ 22.31
Apr-16	720	390	54%	$ 13.82	$ 26.68
May-16	744	254	34%	$ 12.60	$ 24.35
Jun-16	720	75	10%	$ 12.19	$ 22.38
Jul-16	744	21	3%	$ 13.14	$ 19.85
Aug-16	744	10	1%	$ 7.56	$ 15.49
Sep-16	720	68	9%	$ 7.91	$ 15.54
Oct-16	744	73	10%	$ 9.92	$ 16.18
Nov-16	721	59	8%	$ 10.54	$ 11.46
	10249	1669	16%	$ 10.42	$ 21.96

Given the must run generation of 81 MW plus must take wind generation (nameplate capacity of 125MW), for an average load of 185MW, NorthWestern should be concerned about the duration and frequency of times when it is in situations where it cannot further back down its units.

Figure 2 shows the annual projection of the three positions with Juhl's projects: Short, Long and MinGen. positions[19] As can be noted, the Short Position is on an increasing trend and the Long and MinGen Positions are on a declining trend over time, which basically implies that as load growth occurs, the QF is compensated more on market prices.

Figure 2: NorthWestern's Forecast of Net Short, Long and MinGen Positions



Fourth, if the utility paid market prices for all positions, there are adverse consequences for customers:

- If QFs are compensated during instances when no costs are avoided such as the MinGen Position, customers are harmed because that they are paying avoided cost compensation during instances when there are no costs to avoid. Rather, it is costing NorthWestern more than the market prices to keep its must run units running. In

[19] See NorthWestern's response to SDPUC 4-17 (Excel attachment).

order for the purchase rates to be just and reasonable and in the public interest, the compensation should be no more than the avoided costs.

- Customers take all the future market price risk and essentially become market brokers for a 20 year term. For example, Figure 2 shows that for the first 10 years, the long position is approximately 30% of the time

Such outcomes are inconsistent with PURPA. [20]

Thus, for the four foregoing reasons, I find that NorthWestern's methodology of calculating avoided energy costs based on Short, Long and MinGen Positions is reasonable. Therefore, I do not agree with Juhl witness Roger Schiffman's positions of market price compensation irrespective of whether NorthWestern is in a Short, Long or MinGen Position, with the addition of Juhl's projects.

2. *Transparency*

Q. What concerns does Juhl witness Roger Schiffman have regarding model transparency?

A. He finds that the Powersimm model and information, regarding the stochastic process dealing with how the software formulates historical relationship and other facets, lacks transparency.

Q. How do you respond?

[20] See § 292.304 and Order 69 provisions as explained by Commission Staff witness Jon Thurber in his Direct Testimony.

A. Both models are proprietary and have the same issue related to lack of transparency. Neither Juhl nor NorthWestern is able to provide proprietary information for their models. Since both models are trademarked and licensed, this is not surprising. Further, just as witness Schiffman asserts that PROMOD is used in resource planning decisions so is is PowerSimm.[21] As discussed earlier, I find NorthWestern's approach reasonable. No model is perfect and each one will have its pros and cons. Further, it is important to note that NorthWestern is using this same approach for its own planning and is not discriminating against the Juhl QFs.

3. Evaluation of NorthWestern's Avoided Energy Cost Offer for Juhl's Wind QFs

Q. What is the status of the wind generation market?

A. The wind generation market has matured over time and PPA prices for wind generation have dropped significantly. Long term PPAs for wind generation are currently very competitive. In 2013, Xcel Energy acquired wind PPAs through a competitive request for proposal ("RFP") solicitation stating in part, that based on the distribution of levelized costs, Xcel Energy focused its review on bids that were at or below $29/MWh.[22] A Lawrence Berkeley Laboratory report issued in August 2016 indicates that the PPA

[21] See for example, https://blog.ascendanalytics.com/, "Synopsis of the Ascend Best Practices and User Summit", May 24, 2016

[22] See https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BD9399A31-0A89-4843-A054-5AF194970F01%7D&documentTitle=20138-90150-01, See page 9.

prices for wind generation in the mid-section of the country have dropped from ~$55/MWh in 2009 to ~ $20/MWh in 2016.[23]

Q. Has NorthWestern experienced similar pricing offers in 2016?

A. Yes. In its response to SDPUC 5-3, NorthWestern indicated that it received an unsolicited price offer from a third party for 99 MW of wind generation at $21.61/MWh not accounting for possible transmission upgrades or congestion costs. NorthWestern opted to not pursue this generation as this would result in a significant increase in market sales and known congestion in the siting area for the wind generation.

Q. Why are the wind PPA pricing trends relevant in validating the avoided costs calculated by NorthWestern?

A. The wind PPA pricing trends are relevant because had NorthWestern issued a competitive Request for Proposal ("RFP") solicitation for wind, the trends and NorthWestern's unsolicited offer gives an indication for the type of pricing NorthWestern would have received. As noted by Mr. Schiffman, bid prices submitted through the RFP process are also a proxy for the utility's avoided costs and in compliance with PURPA. In response to SDPUC 2-8 (b), Juhl's only concern regarding an RFP approach was that it would cause substantial delay.

Q Is NorthWestern's calculated avoided cost for the Juhl wind QFs consistent with this pricing?

[23] See https://emp.lbl.gov/sites/all/files/2015-windtechreport.final_.pdf

A. Yes. Pricing under $30/MWh for avoided energy costs is certainly more consistent with NorthWestern's calculation compared to Juhl's avoided energy cost projections of $47.29/MWh.

4. ***Alternative Compensation Approach Related To Energy Output***

Q. Is there another alternative where Juhl could get compensated for market prices for all of its output?

A. Yes. Another option is to compensate Juhl at the actual real time hourly locational market prices ("LMP") market prices for every delivered MWh of the QF output. Conceptually, this approach would consist of NorthWestern facilitating the transaction by providing actual real time hourly LMP compensation for delivered power minus an administrative fee and SPP charges. Since Juhl appears to be confident in its forecast of market prices, this option provides Juhl with the ability to receive non-discriminatory and transparent pricing for all of the QF output. Further, I note that while Juhl meets the under 20MW rebuttable presumption resulting in the mandatory obligation for NorthWestern to procure the output, as a practical matter, the total portfolio is 60MW. From a technical perspective, there is non-discriminatory access here to a transparent SPP market and no transmission constraints are highlighted as noted in NorthWestern's response to SDPUC 4-25.

Q. Wouldn't NorthWestern act as a broker here?

A. Yes, but the customers are not taking on the forward market price risk and will not be adversely impacted by this transaction because the QF is getting its compensation for delivered power and paying for any charges or credits. There is no contention about future avoided cost methodology or input prices in this option as prices are set as facilitated by SPP's dispatch mechanisms.

Q. Is such an option used in other jurisdictions?

A. Yes; for example, SouthWestern Public Service Commission (Xcel Energy) uses this approach in Texas. The Public Utilities Commission of Texas ("PUCT") established rules for QFs with non-firm power, where the must purchase option is real time LMPs minus administration/transaction costs. [24] Exhibit Exhibit_KM-2 shows the Xcel Energy tariff used in Texas.

Q. In summary, what are your conclusions and recommendations regarding the methodology for avoided energy costs?

A. My conclusions and recommendations are as follows:

- NorthWestern's modeling approach and related input assumptions are reasonable;
- NorthWestern's modeling approach and related input assumptions are non-discriminatory since the utility uses this same model and related input assumptions for evaluating its own resource planning decisions;

[24] According to § 25.242(c)(9), non-firm power is defined as "[p]ower provided under an arrangement that does not guarantee scheduled availability, but instead provides for delivery as available."

- NorthWestern's approach of assessing avoided costs as market prices for net Short Position, variable costs of the highest economically dispatchable unit for net Long Position, and zero for MinGen Position, is consistent with PURPA;
- NorthWestern's avoided energy cost offer is consistent with the PPA pricing trends for wind generation today, if the utility were to issue a competitive RFP solicitation;
- If Juhl is interested in full market price compensation, an actual real time LMP compensation method at SPP can be facilitated by NorthWestern similar to what is used by Xcel Energy in Texas;
- I therefore recommend NorthWestern's production cost modeling approach for calculating the avoided energy cost. Alternatively, the actual real time LMP approach can also be used.

B. AVOIDED CAPACITY COSTS

Q. What is Juhl's proposal for avoided capacity costs compensation?

A. Juhl would like to lock in a 20 year price including the $/KW-year charge and the accredited capacity. Juhl recommends basing the avoided capital cost of a simple cycle power plant and would like to lock is an accredited capacity of 5% for the 20 year contract term.

Q. What is NorthWestern's proposal?

A. NorthWestern proposes to lock in an indicative price it received for $3.50/KW month increasing at 2% per year. Further, NorthWestern recommends using the accredited capacity method prescribed by SPP, which refreshes the accredited capacity for wind

generation at least once, every three years. The accredited capacity of any generation resource is the amount of MWs that a utility can rely on, to fulfill its planning reserve margin requirement.

Q. What is your response?

A. Since NorthWestern has a capacity need starting in 2019, a QF should get capacity credit for its accredited capacity starting in 2019. The cost of new entry of a simple cycle peaking plant is generally regarded as the avoided capacity cost and therefore, the capacity payment should be based on such a plant. NorthWestern provided the levelized avoided costs for a 20 year term in its response to SDPUC 4-23. The methodology should consist of locking in the levelized avoided costs. However, with respect to the accredited capacity, the compensation should be provided for the net dependable or accredited capacity which is updated at least once every three years as per the SPP provisions. Wind generation is a variable and intermittent resource and its accredited capacity could vary widely depending on its performance. Therefore, it makes sense to refresh the accredited capacity using the SPP method in order to properly calculate the avoided capacity obligation. Thus, I recommend a levelized long term avoided capacity cost and accredited capacity based on the SPP method. Further, since the capacity MWs will change at least once every three years, it should not be converted into a $/MWh amount but rather be submitted to Juhl as a fixed amount on a monthly basis (annual amount divided by 12). For example, for the first three years, the annual avoided capacity cost was calculated as $353,336 for the three projects. On a monthly basis, this results in a payment of $29,445.

C. CALCULATION OF WIND INTEGRATION COSTS

Q. What is NorthWestern's position regarding wind integration costs?

A. NorthWestern witness Bleau LaFave indicates that the Juhl projects will impose incremental costs associated with regulation ancillary services and that these costs should be deducted from the avoided cost credit. He calculated the regulation costs using SPP determination of regulation per MWh of wind energy at $0.24/MWh using 2015 data. He escalated this rate using the same EIA growth rate as used for the natural gas and electricity forecasts.

Q. How did Juhl respond?

A. In Juhl's response to SDPUC 3-8, Juhl found NorthWestern's initial estimate reasonable. However, Juhl recommended a 2% escalation rate.

Q. How do you respond?

A. I agree that the regulation costs should be accounted for and deducted from the energy avoided costs. I also agree with NorthWestern's position of escalating future years using the same escalation rate as used in the electricity and natural gas price forecasts as this results in consistent treatment.

D. INCLUSION OF INTERCONNECTION COSTS

Q. Prior to discussing NorthWestern's and Juhl's position regarding interconnection costs, which issues do you wish to address?

A. I address the following:

- The points of interconnection requested by Juhl for the three wind QFs;

- The interconnection cost categories; and
- Whether the Commission has jurisdiction.

Q. What is the point of interconnection for the three Juhl wind projects?

A. The three Juhl wind projects are proposed to be connected on NorthWestern's distribution system. Two projects are to be interconnected to a 69KV line and the third project is to be interconnected to a 34.5KV line. Exhibit_KM-3 and Exhibit_KM-4 show the locations, which were provided by NorthWestern in response to SDPUC 5-7. NorthWestern notes in its response to SDPUC 5-5, that Juhl requested interconnections to NorthWestern's system in the middle of the distribution lines, which will require construction of a new substation for each project.

Q. What are the interconnection cost categories?

A. NorthWestern witness Bleau LaFave identifies three cost categories: Transmission Provider Interconnection Facilities ("TPIF"), Network charges identified by NorthWestern and transmission service level network upgrade costs identified by SPP. The TPIF costs are directly paid by the interconnection customer. The network charges are paid upfront by the interconnection customers and once the project is commercial, the interconnection customer is reimbursed the entire amount plus interest over time. The network charges in this case are associated with the three new substations that need to be constructed in order to accommodate Juhl's request for interconnecting the three projects. Transmission level network upgrades are costs identified by SPP. It is my understanding that the cost allocation policy for SPP network upgrades is also handled similarly as NorthWestern's network upgrade costs where the interconnection customer pays for the costs upfront and these costs are later reimbursed to the customer over time.

Q. **Does the policy surrounding the treatment of interconnection costs fall under the South Dakota jurisdiction for the Juhl QFs?**

A. Yes. Since the Juhl projects are to be designated as QFs and will be contractually restricted to sell their output to only NorthWestern, the Commission has jurisdiction over treatment of the interconnection costs. [25]

On the other hand, I believe that if Juhl had opted to be a merchant developer and took interconnection service from NorthWestern's system but contracted with an entity other than NorthWestern for its output, the policy would be under the FERC jurisdiction. At the FERC level, however, while the costs of the network charges are refunded back to the interconnection customer, Juhl, as a merchant developer, would be exposed to transmission related service charges on an on-going basis to deliver the power. Thus, under the FERC jurisdiction, while there are refunds associated with interconnection costs, costs are recovered via transmission service charges.

Q. What is NorthWestern's position regarding the network charges?

A. NorthWestern witness Bleau LaFave indicates that the costs of the interconnection network upgrades will be included in NorthWestern's South Dakota rate base and will be recovered from customers. His position is that the costs of the network upgrades should be deducted from the avoided cost payments for the projects in order to prevent customers from shouldering this cost burden. The costs are estimated at $7.29 million. Mr. Bleau LaFave explains on page 18 of his Direct Testimony that because the life of the assets are longer than the contract term, the net present value of the annual cost to

[25] See NorthWestern's supplemental response to SDPUC 5-6.

customers was calculated. Using the net present value, a payment stream was calculated for the 20-year life of the contract. Using the payment streams and project Juhl output, he provided a $/MWh cost which he recommends deducting from the avoided cost credits. He also states that to the extent that SPP identifies any network upgrade costs, those costs should also be deducted from the avoided cost payments.

Q. What is Juhl's position regarding this matter?

A. Juhl witness Roger Schiffman testifies that the proposed deduction unfairly discriminates against QF resources. Specifically, he states the following:

> I believe the proposed adjustment is a violation of FERC transmission interconnection policy, and unfairly discriminates against QF resources. For example, if a merchant generator sought interconnection on the NorthWestern transmission system, it would be required to pay for network upgrade costs during the development stage, but when it achieves commercial operation, those costs would be refunded by NorthWestern. As NorthWestern would have no contractual operation to purchase power from that merchant resource, it would also have no opportunity to try and recover network upgrade costs. So under NorthWestern's proposed avoided cost adjustment, a QF would be required to pay for network upgrade costs, but a merchant plant would not. That is the definition of discriminatory pricing treatment, and highlights how NorthWestern's proposed adjustment is discriminatory and in violation of PURPA.[26]

Q. What is your response in regards to Juhl's assertions?

A. I do not agree with Juhl that NorthWestern's approach is discriminatory and in violation of PURPA. This is because of the following:

First, if a merchant developer sought interconnection on NorthWestern's system, paid for the interconnection costs in the development stage and was refunded by NorthWestern, but did not have a contract to sell its output to NorthWestern, it would still end up paying transmission service charges to deliver the power.

[26] See Roger Schiffman's Direct Testimony on page 14.

Second, unlike the merchant developer situation where the cost recovery for network upgrades is through transmission service charges, there is no avenue to recover costs in Juhl's case as a QF with must purchase obligations with NorthWestern. There is no double recovery of costs because the interconnection costs are refunded back to Juhl upon achieving commercial operation of its QFs and Juhl does not pay transmission service charges.

Q. Are there any avoided costs associated with these network upgrades?

A. No. Ratepayers are bearing the cost burden of the substations and there is no avoided cost because the substations are being built to accommodate Juhl's projects and there are no system benefits at this time as noted in NorthWestern's response to SDPUC 5-7 (b).

Q. What should be the treatment of the interconnection costs associated with network upgrades?

A. Since ratepayers are bearing the cost burden and there are no offsetting transmission service charges to recover the costs, I support NorthWestern's position in deducting the costs of the interconnections associated with network upgrades at NorthWestern and SPP, from the avoided cost payments. This approach is consistent with cost causation principles. I also support NorthWestern's proposed approach of calculating the costs over the 20 year contract term.

Q. If over time, the newly constructed substations paid for by Juhl are used as interconnection points by other customers or by the utility itself, should Juhl be refunded some portion of these costs?

A. Yes. If the network upgrades paid for by Juhl are used by either NorthWestern to interconnect new generation or another interconnection customer, Juhl should receive refunds. The refund methodology could be based on the proportion of substation capacity used by Juhl and a new customer or NorthWestern, respectively. In rebuttal testimony, NorthWestern should explain (a) how it currently handles facility specific upgrades for a customer that are later used by others, and (b) also provide justification for the specific capacity and related configurations of the three substations to address Juhl's interconnection requests for the three QF projects. I will be submitting additional discovery requests and I will update my position based on the responses at the Hearing.

Q. Do you have any additional comments regarding this matter?

A. Yes. The recommended cost methodology of deducting the interconnection costs from the avoided cost credits will provide the appropriate pricing signal for siting facilities in NorthWestern's service territory. I would note that Oak Tree and Beethoven interconnected at existing sub stations to minimize the costs of network upgrades.

Q. **Does this conclude your testimony?**

A. Yes.