

Rebuttal Testimony and Schedules  
Steven W. Wishart

Before the North Dakota Public Service Commission  
State of North Dakota

In the Matter of the Application of  
Northern States Power Company, a Minnesota Corporation  
for an Advance Determination of Prudence for a  
200 MW Prairie Rose Wind Generation Project and  
Power Purchase Agreement with Geronimo Wind Energy, LLC

Case Nos. PU-12-059  
Exhibit\_\_\_ (SWW-2)

**Modeling**

October 4, 2012

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## SCHEDULES

Prairie Rose Capacity Credit	Schedule 1
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1 **I. INTRODUCTION**

2  
3 Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

4 A. My name is Steven W. Wishart. My business address is 414 Nicollet Mall, 7th  
5 Floor, Minneapolis, MN 55401.

6  
7 Q. ARE YOU THE SAME STEVEN WISHART WHO SUBMITTED PRE-FILED DIRECT  
8 TESTIMONY IN THIS PROCEEDING?

9 A. Yes.

10  
11 Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?

12 A. The purpose of my testimony is to discuss the Strategist modeling questions  
13 raised in Mr. Raymond Hahn's Direct Testimony on behalf of Commission  
14 Staff, and to clarify some of the items that appear to be sources of confusion.  
15 Our conservative modeling results continue to support the reasonableness of  
16 the Prairie Rose Wind, LLC (Prairie Rose or PRW) Power Purchase  
17 Agreement (PPA).

18  
19 **II. STRATEGIST PLANNING MODEL**

20  
21 Q. WHAT STRATEGIST MODELING ISSUES DO YOU WISH TO ADDRESS IN YOUR  
22 REBUTTAL TESTIMONY?

23 A. I will provide support for the discussion in Mr. Haeger's testimony regarding  
24 the conservative nature of the assumptions in our Strategist modeling. In  
25 particular, I will address the inclusion of a capacity credit in our Strategist  
26 model, wind integration costs, and our natural gas alternative analysis.

27

1 Q. WHAT IS YOUR RESPONSE TO MR. HAHN’S CONTENTION THAT THE PRAIRIE  
2 ROSE PPA SHOULD NOT REFLECT A CAPACITY CREDIT IN THE STRATEGIST  
3 MODEL?

4 A. I agree with Mr. Haeger that it is technically feasible and economically  
5 beneficial to our customers to convert the Prairie Rose project to a  
6 conventional interconnection at some point in the future.

7

8 As discussed by Mr. Oye for the Company, MISO’s planned multi-value  
9 project (MVP) portfolio and other transmission projects are expected to  
10 increase transmission outlet in the area of the Prairie Rose project, coinciding  
11 with the Company’s next expected capacity resource need in 2017-2018. In  
12 our latest resource planning analysis, the capacity need in 2017-2018 is to be  
13 met with natural gas combustion turbines (CTs). Our preliminary estimate of  
14 the capacity cost of these CTs is approximately \$7.00/kW-month. Using this  
15 cost assumption, the value of the 24 MW potentially available from PRW is \$2  
16 million per year.<sup>1</sup>

17

18 This potential savings gives the Company strong incentive to consider  
19 conversion of the PRW project to a conventional interconnection once the  
20 MVP transmission projects are complete. Because the PRW project  
21 represents “low hanging fruit” for a capacity addition, I believe it is reasonable  
22 to assume for modeling purposes that the Company will capture this capacity  
23 benefit. As a result, we include a capacity credit in the Strategist modeling,  
24 starting in 2018 based on the price of a CT.

25

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<sup>1</sup> \$7.00/kW-mo x 24MW x 12months = \$2,016,000

1 Q. IS THIS A CHANGE FROM YOUR DIRECT TESTIMONY?

2 A. Yes. We initially incorporated a capacity credit starting in 2013. Consistent  
3 with our generally conservative modeling approach and Mr. Hahn's  
4 assessment that 2013 capacity accreditation is not expected, we have reduced  
5 the value of the capacity credit in the model to reflect a 2018 conversion to a  
6 conventional interconnection.

7

8 In Exhibit \_\_\_\_ (SWW-2), Schedule 1, I provide the calculation of this revised  
9 capacity credit. The revised capacity credit value is \$13.5 million in terms of  
10 present value of revenue requirements (PVRR). This is a \$4.2 million decrease  
11 in the credit from the \$17.7 million in my original analysis.

12

13 Q. PLEASE EXPLAIN HOW THE WIND INTEGRATION COST ASSUMPTIONS USED IN  
14 STRATEGIST ARE GENERALLY CONSERVATIVE.

15 A. The Company used a conservative estimate of wind integration costs for the  
16 Prairie Rose project based on the 2006 Minnesota Wind Integration Study.  
17 However, there are three reasons why actual wind integration costs are likely  
18 to be lower than the original estimate used in the Strategist modeling:

19 • The wind integration costs were based on a modeling assumption of  
20 \$9/mmBtu gas. This was the forecasted price of natural gas when the  
21 Wind Integration Study was conducted in 2006. By the time the  
22 Company was analyzing the system cost impacts of the PRW PPA  
23 using Strategist, natural gas prices had fallen significantly. Lower gas  
24 prices have the effect of reducing wind integration costs, as natural gas  
25 fired units are the primary source of operating reserves used to integrate  
26 wind. However, because the Prairie Rose project was cost effective  
27 when employing the older wind integration cost estimate based on

1           \$9/mmBtu gas, we decided to keep this conservative cost estimate in  
2           the model and not update the value until a new integration study could  
3           be completed.

- 4           • The integration costs used in Strategist also assumed a 25% wind  
5           penetration level, consistent with the 2006 Wind Integration Study.  
6           However, Prairie Rose is only expected to bring total wind penetration  
7           on the NSP system to 13% (NSP System includes all customers in  
8           North Dakota, South Dakota, Minnesota, Wisconsin, and Michigan).  
9           Study results showed that average integration costs were lower for  
10          lower levels of wind penetration on a \$/MWh basis. So, the PRW  
11          project was modeled with extra costs related to additional levels of wind  
12          that may or may not be added to the system in the future.
- 13          • The 2006 Wind Integration study was based on the assumption that as  
14          wind is added to the NSP System, additional operating reserves must  
15          also be added to compensate for wind generation's intermittent  
16          characteristics. But since 2006, operating reserves required by MISO  
17          have actually fallen as a result of implementation of the MISO Ancillary  
18          Services Market. This is not conclusive evidence that wind does not  
19          require ancillary services; however, it does contradict the expectation  
20          that operating reserves would necessarily need to be increased with  
21          additions of wind energy. The only identifiable "costs adders"  
22          attributable to placing more wind on the MISO system are the MISO  
23          Revenue Sufficiency Guarantee charges that are incurred due to  
24          inaccurate day-ahead forecasts of wind generation. Using the best  
25          available information, from January 2011 through August 2012 these  
26          charges averaged only \$0.28/MWh of wind generation, compared to

1 the approximately \$3.00/MWh wind integration cost assumed in the  
2 Strategist modeling.

3  
4 Q. HOW DID THE CONSERVATIVE LEVEL OF WIND INTEGRATION ASSUMED IN THE  
5 MODEL IMPACT YOUR INITIAL ANALYSIS?

6 A. The Strategist model assumed that wind integration in 2013 would cost  
7 \$2.82/MWh and escalate at an average of 5.1% through the term of the PPA.  
8 The impact of this assumption was to effectively add \$4.28/MWh to the  
9 levelized price of the Prairie Rose project. The impact on the Strategist PVRR  
10 was \$29 million. This assumption is overly conservative for the reasons  
11 explained previously.

12  
13 Q. HOW DOES INCORPORATING THE LOWER GAS PRICES AND LOWER WIND  
14 PENETRATION LEVELS INTO YOUR ANALYSIS AFFECT YOUR ESTIMATE OF WIND  
15 INTEGRATION COSTS?

16 In the Strategist modeling completed for the Prairie Rose project, gas prices  
17 started at \$5.22/mmBtu in 2013 and escalated at an average rate of 4.1%,  
18 compared to the \$9/mmBtu assumed in the 2006 Wind Integration Study.  
19 And the Prairie Rose project will put wind penetration at about 13%  
20 compared to 25% contemplated in the study. Adjusting for these two factors,  
21 the estimated wind integration costs in 2013 are \$1.48/MWh, escalating at  
22 4.1%. The levelized cost is \$2.22/MWh and the revised PVRR impact of the  
23 integration costs would be \$15 million, rather than our initial estimate of \$29.3  
24 million. See Exhibit \_\_\_\_ (SWW-2), Schedule 2. I believe this approach is  
25 more accurate, as it uses the same gas prices that were used in the rest of the  
26 Strategist modeling at the time we conducted our analysis in early 2011, and

1 only burdens the project for the wind penetration levels that Prairie Rose is  
 2 expected to cause.

3  
 4 I further believe that even this lower level of wind integration costs is  
 5 conservative. As I explained previously, our recent experience with MISO has  
 6 been that the additional system costs associated with adding wind have  
 7 averaged only \$0.28/MWh. As this is a relatively new development, however,  
 8 I have not factored our recent experience into my revised analysis at this time.

9  
 10 Q. ASSUMING NO OTHER CHANGES IN THE MODEL, DO THESE CHANGES IN THE  
 11 CAPACITY CREDIT AND WIND INTEGRATION COSTS AFFECT YOUR ASSESSMENT  
 12 OF THE REASONABLENESS OF THE PRAIRIE ROSE PPA?

13 A. No. My original Strategist analysis resulted in an estimated PVRR impact of  
 14 \$5.4 million. The \$4.2 million reduction in the capacity credit increases the  
 15 overall cost of the project, but this is offset by the \$14.1 million reduction in  
 16 wind integration costs. After these changes are reflected, the value of the  
 17 Prairie Rose project to the NSP System is greater than originally estimated:

18  
 19 **Net Benefit of PRW PPA**  
 20 PVRR Impacts (\$millions)

21

	<b>Original Strategist Analysis</b>	<b>Change to Original Values</b>	<b>Updated Strategist Analysis</b>
Net Energy Savings	(\$5.7)		(\$5.7)
Capacity Savings	(\$17.7)	+ \$4.2	(\$13.5)
Wind Integration Costs	\$29.3	-\$14.1	\$15.2
<u>SOx Value</u>	<u>(\$0.4)</u>		<u>(\$0.4)</u>
<b>Total</b>	<b>\$5.4</b>		<b>(\$4.5)</b>

22

23



1 Q. MR. HAEGER PRESENTED A RANGE OF REASONABLE COST ESTIMATES FOR THE  
2 PRAIRIE ROSE PROJECT. HOW DOES YOUR UPDATED STRATEGIST ANALYSIS  
3 COMPARE?

4 A. Our results are largely the same, with one exception. The Strategist analysis  
5 does not include a value for renewable energy credit (REC) sales. While it is  
6 understood that RECs allocated to North Dakota will be sold for the benefit  
7 of North Dakota customers at some point in the future, a majority of Prairie  
8 Rose wind RECs will be allocated to other states and retired for renewable  
9 energy standard compliance. Therefore, in Strategist we typically do not  
10 include the impact of REC sales. However, given Mr. Hahn's suggestion that  
11 the Company monetize the RECs accrued to our North Dakota customers, I  
12 believe it is appropriate to include some measurement of REC value in the  
13 modeling assumptions we use for the PRW PPA. As described in Mr.  
14 Haeger's Rebuttal Testimony, using very conservative REC pricing  
15 significantly increases the benefits of the Prairie Rose project.

16

17 Q. MR. HAHN CONTENDS THAT THE NATURAL GAS PRICING ASSUMPTIONS IN THE  
18 STRATEGIST MODEL SHOULD BE THOSE IN EFFECT WHEN THE ADVANCE  
19 DETERMINATION OF PRUDENCE (ADP) APPLICATION WAS FILED. HAVE YOU  
20 ADJUSTED YOUR MODEL TO ACCOUNT FOR THIS SUGGESTION?

21 A. No. Our model is intended to represent the factors in place at the time the  
22 decision was made to enter into the Prairie Rose PPA. The type of update  
23 suggested by Mr. Hahn is only plausible when you have the benefit of 20/20  
24 hind sight. When the wind bids were received in the 2010 RFP, we performed  
25 the Strategist analysis with the best information available at the time, which  
26 included a blend of natural gas forecasts from three industry-respected  
27 consulting firms. Neither the Company nor our consulting firms had

1 foreknowledge that natural gas prices would continue their decline throughout  
2 the year.

3  
4 In addition, regardless of natural gas prices Prairie Rose was the lowest cost  
5 project identified among over 100 bids received through the RFP process, and  
6 the lowest cost wind project we have seen recently. The project will provide  
7 low cost, clean energy and valuable diversification to our energy resource  
8 portfolio even if the economic analysis is viewed differently than we propose.

9  
10 **III. NATURAL GAS ALTERNATIVE ANALYSIS**

11  
12 Q. WHAT IS YOUR RESPONSE TO MR. HAHN'S ASSERTION THAT THE CAPACITY  
13 CREDIT SHOULD HAVE BEEN REMOVED FROM THE NATURAL GAS  
14 ALTERNATIVE ANALYSIS, AND THAT MORE RECENT GAS PRICING ASSUMPTIONS  
15 SHOULD HAVE BEEN USED?

16 A. For the reasons stated previously, we continue to believe that the appropriate  
17 modeling approach is to assume a capacity credit beginning in the year 2018  
18 and natural gas pricing as of January 2011 – when the Prairie Rose PPA was  
19 executed – for either Strategist or the natural gas alternative analysis.

20  
21 Q. HOW WOULD THIS POSITION AFFECT YOUR DETERMINATION OF THE  
22 REASONABLENESS OF THE PRAIRIE ROSE PROJECT?

23 A. Because we believe our initial assessment was perhaps overly conservative, we  
24 believe the actual PVRR impact of the Prairie Rose PPA is likely to be  
25 significantly lower than initially estimated. This provides further support for  
26 the prudence of the Prairie Rose PPA.

27

1 Q. DO YOU AGREE WITH MR. HAHN'S RECOMMENDATION THAT ONLY THE  
2 STRATEGIST ANALYSIS SHOULD BE USED AS A BASIS FOR DETERMINING THE  
3 PRUDENCE OF THE PRAIRIE ROSE PPA?

4 A. No. The natural gas alternative analysis allows us to make a comparison  
5 between the Prairie Rose PPA and a conventionally-fueled resource. Such a  
6 comparison is important to assess the prudence of the PPA. While Mr. Hahn  
7 is correct that, by definition, the range of alternatives depicted by the natural  
8 gas alternative analysis is not as comprehensive as the Strategist analysis, the  
9 natural gas alternative analysis simply offers an alternative comparison. The  
10 natural gas analysis shows that the Prairie Rose PPA is still less costly than the  
11 natural gas alternative. In conjunction with Strategist modeling, these results  
12 underscore the overall prudence of the Prairie Rose PPA.

13

14 **IV. CONCLUSION**

15

16 Q. PLEASE SUMMARIZE YOUR TESTIMONY.

17 A. In response to Mr. Hahn's testimony and our own analyses, we have  
18 considered the impacts of delaying the impact of the capacity benefit from  
19 Prairie Rose and of reduced wind integration costs. I disagree with Mr.  
20 Hahn's contention that the natural gas prices used in our analysis and decision  
21 to proceed with the PRW project should have been updated retroactively for  
22 purposes of determining prudence. Overall, our modeling results are robust  
23 and bear out the prudence of the Prairie Rose PPA.

24

25 Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

26 A. Yes, it does.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2													
3	<b>Prairie Rose Capacity</b>												
4		<b>Name Plate Capacity (MW)</b>	<b>Accredited Capacity (%)</b>	<b>Accredited Capacity (MW)</b>				<b>Accredited Capacity</b>	<b>Capacity Value (\$/kW-mo)</b>		<b>Total Capacity Credit (\$000)</b>		
5	2012				2012								
6	2013	200	12%	24	2013								
7	2014	200	12%	24	2014								
8	2015	200	12%	24	2015								
9	2016	200	12%	24	2016								
10	2017	200	12%	24	2017								
11	2018	200	12%	24	2018	-24	\$7.37	-\$2,123					
12	2019	200	12%	24	2019	-24	\$7.52	-\$2,165					
13	2020	200	12%	24	2020	-24	\$7.67	-\$2,208					
14	2021	200	12%	24	2021	-24	\$7.82	-\$2,251					
15	2022	200	12%	24	2022	-24	\$7.97	-\$2,296					
16	2023	200	12%	24	2023	-24	\$8.13	-\$2,341					
17	2024	200	12%	24	2024	-24	\$8.29	-\$2,387					
18	2025	200	12%	24	2025	-24	\$8.45	-\$2,434					
19	2026	200	12%	24	2026	-24	\$8.61	-\$2,481					
20	2027	200	12%	24	2027	-24	\$8.78	-\$2,529					
21	2028	200	12%	24	2028	-24	\$8.95	-\$2,578					
22	2029	200	12%	24	2029	-24	\$9.12	-\$2,628					
23	2030	200	12%	24	2030	-24	\$9.30	-\$2,679					
24	2031	200	12%	24	2031	-24	\$9.48	-\$2,731					
25	2032	200	12%	24	2032	-24	\$9.67	-\$2,784					
26													
27													
28													

  

<b>NPV (\$000)</b>	<b>-\$13,507</b>
--------------------	------------------

7.56% Discount Rate

Aproximate completion of MVP Projects

The price of a CT was based on generic units developed for the 2010 Minnesota Resource Plan. Prices were escalated at 1.9%, the assumed inflation rate.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y		
3	<b>Original Wind Integration Assumption</b>																										
4		NPV	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033		
5	\$/MWh		\$0.00	\$0.00	\$2.82	\$3.00	\$3.19	\$3.38	\$3.58	\$3.78	\$3.84	\$4.16	\$4.22	\$4.59	\$4.39	\$4.58	\$4.92	\$5.41	\$5.82	\$6.47	\$7.01	\$7.18	\$7.21	\$7.22	\$7.28		
6	CWth		-	-	726	726	726	726	726	726	726	726	726	726	726	728	726	726	726	726	728	726	726	726	728		
7	Total Cost (\$000)		\$29,314	\$0	\$2,047	\$2,177	\$2,315	\$2,459	\$2,598	\$2,743	\$2,787	\$3,027	\$3,063	\$3,331	\$3,186	\$3,332	\$3,571	\$3,926	\$4,224	\$4,707	\$5,088	\$5,211	\$5,233	\$5,253	\$5,253		
8																											
9																											
10	<b>2006 Wind Integration Adjusted For Gas Assumption &amp; Wind Penetration Assumption</b>																										
11	The original wind integration assumption was based on \$9/mmbtu gas and a 25% wind penetration level. This																										
12	section adjusts for gas prices used in the Prairie Rose CON and a 15% wind penetration level which is slightly above																										
13	the level estimated for Prairie Rose Wind.																										
14																											
15																											
16																											
17	<b>2006 Wind Integration Study pg 75</b>																										
18		Annual Wind Patterns				Average		This is a 2020 value assuming																			
19	Wind Penetration Levels	2003	2004	2005	\$9/mmbtu gas price.																						
20	15%	\$2.97/MWh	\$2.56/MWh	\$2.11/MWh	\$2.55/MWh																						
21	20%	\$4.09/MWh	\$2.73/MWh	\$2.71/MWh	\$3.18/MWh																						
22	25%	\$4.41/MWh	\$2.83/MWh	\$2.95/MWh	\$3.40/MWh																						
23																											
24	<b>Ratio Value for 2020 gas price used in Prairie Rose Analysis.</b>																										
25																											
26	2020 Integration Cost	\$2.55/MWh	X	\$7.81	PRW 2020 Gas Price		=																			\$2.21/MWh	
27				\$9.00	2006 Study Assumption																						
28																											
29																											
30	<b>Apply Updated 2020 Value to Stream of Gas Prices used in PRW Analysis</b>																										
31		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033				
32	PRW Gas Prices	\$4.83	\$5.22	\$5.77	\$6.56	\$6.85	\$7.00	\$7.15	\$7.49	\$7.81	\$8.22	\$8.66	\$8.93	\$8.88	\$9.26	\$9.56	\$9.80	\$10.13	\$10.44	\$10.78	\$11.02	\$11.25	\$11.25				
33	Revised Integration Costs	\$1.37/MWh	\$1.48/MWh	\$1.63/MWh	\$1.86/MWh	\$1.94/MWh	\$1.98/MWh	\$2.02/MWh	\$2.12/MWh	\$2.21/MWh	\$2.33/MWh	\$2.45/MWh	\$2.52/MWh	\$2.51/MWh	\$2.62/MWh	\$2.70/MWh	\$2.77/MWh	\$2.86/MWh	\$2.95/MWh	\$3.05/MWh	\$3.12/MWh	\$3.18/MWh	\$3.18/MWh				
34	CWth	-	726	726	726	728	726	726	726	726	726	726	726	728	726	726	726	728	726	726	726	726	728				
35	Total Cost (\$000)	\$0	\$1,071	\$1,183	\$1,346	\$1,408	\$1,436	\$1,466	\$1,538	\$1,608	\$1,688	\$1,778	\$1,832	\$1,826	\$1,900	\$1,962	\$2,012	\$2,084	\$2,142	\$2,213	\$2,261	\$2,315	\$2,315				
36	NPV	\$15,177																									
37																											