ADDITIONAL REPORTING REQUIREMENTS (NON-MISO)

5. Wind Curtailment Report (Docket Nos. E002/M-00-622, E002/M-02-51, E002/M-04-404, E002/CN-01-1958, E002/M-04-864, E,G999/AA-04-1279, E002/M-05-1850, E002/M-05-1934 and E002/M-06-85)

The Company has been providing wind curtailment reporting in its monthly FCA reports since the May FCA report dated April 28, 2004. Additionally, the Commission's April 4, 2006 Order regarding curtailment payments to wind developers introduced a new element to the regulatory review of wind power purchases—projection of curtailment costs given existing and planned wind-generated energy purchases and the transmission system. Part H, Section 5, Schedule 1 contains a summary of wind production and curtailment payments during the July 1, 2018 – December 31, 2019 AAA reporting period.

Part H, Section 5, Schedule 2 contains an explanation of the factors affecting wind curtailment costs for the 2018-2019 AAA reporting period. We discussed wind curtailment forecasting in our May 1, 2019 Petition in Docket No. E002/AA-19-293 which presented our 2020 fuel forecast, and will update that discussion in our 2021 fuel forecast Petition to be filed on May 1, 2020. Actual curtailment expenses depend on the wind resource experienced at each turbine, the timing of outages of existing transmission facilities and construction of additional transmission facilities, and the operation of wind generators as Dispatchable Intermittent Resources (DIR) in the MISO energy market.

Northern States Power Company
Electric Utility - State of Minnesota
Wind Curtailment Summary Report - Total
For January 2017 to December 2019

Production Month	Date Paid: Delivered MWh	Date Paid: Lost MWh	Wind Production Delivered: MWh Delivered	Wind Production Delivered: Amount Xcel Energy Paid	Lost Production: Lost MWh	Lost Production: Amount Xcel Energy Paid	Total Xcel Energy Paid
Jan-17			430,915.00	16,121,114.26	3,697.00	157,640.79	$ 16,278,755.05
Feb-17			413,435.00	16,507,567.11	6,934.00	276,825.34	$ 16,784,392.45
Mar-17			416,890.00	16,715,428.81	11,980.00	523,111.92	$ 17,238,540.73
Apr-17			457,766.00	14,278,919.80	7,291.00	309,809.33	$ 14,588,729.13
May-17			419,789.00	15,783,918.29	5,970.00	243,464.35	$ 16,027,382.64
Jun-17			325,258.00	12,144,565.98	6,822.00	309,043.74	$ 12,453,609.72
Jul-17			225,540.00	8,477,405.53	277.00	14,625.98	$ 8,492,031.51
Aug-17			179,181.00	6,687,158.36	54.00	2,734.06	$ 6,689,892.42
Sep-17			348,409.00	13,076,351.03	1,268.00	65,237.53	$ 13,141,588.56
Oct-17			516,819.00	19,352,565.13	2,931.00	133,307.49	$ 19,485,872.62
Nov-17			496,866.00	18,739,626.55	435.00	18,782.21	$ 18,758,408.76
Dec-17			494,304.00	18,583,732.70	479.00	16,365.01	$ 18,600,097.71
Total-17			4,725,172.00	$ 176,468,353.55	48,138.00	$ 2,070,947.75	$ 178,539,301.30
Jan-18			517,112.61	19,554,286.92	1,511.09	61,457.59	$ 19,615,744.51
Feb-18			418,166.06	15,810,253.22	233.23	10,491.35	$ 15,820,744.57
Mar-18			456,664.46	17,253,894.46	840.25	35,475.95	$ 17,289,370.41
Apr-18			389,872.84	14,871,852.82	2,458.29	108,258.95	$ 14,980,111.77
May-18			321,602.85	12,231,504.86	805.13	39,345.01	$ 12,270,849.87
Jun-18			376,960.04	14,294,249.66	956.44	37,717.50	$ 14,331,967.16
Jul-18			252,109.41	9,524,606.84	558.38	25,341.15	$ 9,549,947.99
Aug-18			260,557.95	9,854,956.67	564.99	26,170.63	$ 9,881,127.30
Sep-18			372,900.25	14,204,082.85	1,483.22	64,512.97	$ 14,268,595.82
Oct-18			406,941.22	15,440,333.05	392.86	18,908.20	$ 15,459,241.25
Nov-18			391,946.75	14,949,146.73	1,497.05	66,292.63	$ 15,015,439.36
Dec-18			376,229.82	14,485,535.21	10,741.09	338,305.25	$ 14,823,840.46
Total-18			4,541,064.26	$ 172,474,703.29	22,042.03	$ 832,277.18	$ 173,306,980.47
Jan-19			409,935.57	15,794,417.19	2,691.44	138,614.09	$ 15,933,031.28
Feb-19			316,550.82	12,067,583.35	1,755.04	84,703.94	$ 12,152,287.29
Mar-19			411,474.86	15,202,176.47	1,869.04	93,395.08	$ 15,295,571.55
Apr-19			320,446.94	11,945,738.10	15,514.36	714,235.19	$ 12,659,973.29
May-19			419,819.81	14,792,059.29	8,719.31	367,154.52	$ 15,159,213.81
Jun-19			307,889.93	10,765,318.39	2,914.02	116,848.22	$ 10,882,166.61
Jul-19			261,647.61	9,175,408.30	5,882.20	225,357.99	$ 9,400,766.29
Aug-19			238,064.67	8,453,872.37	1,705.60	68,807.54	$ 8,522,679.91
Sep-19			422,465.39	15,040,484.98	1,016.19	47,264.76	$ 15,087,749.74
Oct-19			527,632.25	18,941,335.79	11,579.78	477,171.98	$ 19,418,507.77
Nov-19			473,817.83	16,580,511.84	1,818.16	77,049.29	$ 16,657,561.13
Dec-19			407,457.50	14,226,050.46	1,527.30	70,126.80	$ 14,296,177.26
Total-19			4,517,203.15	$ 162,984,956.53	56,992.45	$ 2,480,729.40	$ 165,465,685.93

Northern States Power Company
Electric Utility - State of Minnesota
Wind Curtailment Summary Report - Code 1 (ATC)
For January 2017 to December 2019

Production Month	Date Paid		Wind Production Delivered		Lost Production		Total Xcel Energy Paid
	Delivered MWh	Lost MWh	MWh Delivered	Amount Xcel Energy Paid	Lost MWh	Amount Xcel Energy Paid	
Jan-17			-	*0.00*	-	*0.00*	
Feb-17			-	*0.00*	-	*0.00*	
Mar-17			-	*0.00*	-	*0.00*	
Apr-17			-	*0.00*	-	*0.00*	
May-17			-	*0.00*	-	*0.00*	
Jun-17			-	*0.00*	-	*0.00*	
Jul-17			-	*0.00*	-	*0.00*	
Aug-17			-	*0.00*	-	*0.00*	
Sep-17			-	*0.00*	-	*0.00*	
Oct-17			-	*0.00*	-	*0.00*	
Nov-17			-	*0.00*	-	*0.00*	
Dec-17			-	*0.00*	-	*0.00*	
Total-17			*0.00*	*$* -	*0.00*	*$* -	
Jan-18			-	*0.00*	-	*0.00*	
Feb-18			-	*0.00*	-	*0.00*	
Mar-18			-	*0.00*	-	*0.00*	
Apr-18			-	*0.00*	-	*0.00*	
May-18			-	*0.00*	-	*0.00*	
Jun-18			-	*0.00*	-	*0.00*	
Jul-18			-	*0.00*	-	*0.00*	
Aug-18			-	*0.00*	-	*0.00*	
Sep-18			-	*0.00*	-	*0.00*	
Oct-18			-	*0.00*	-	*0.00*	
Nov-18			-	*0.00*	-	*0.00*	
Dec-18			-	*0.00*	-	*0.00*	
Total-18			*0.00*	*$* -	*0.00*	*$* -	
Jan-19			-	*0.00*	-	*0.00*	
Feb-19			-	*0.00*	-	*0.00*	
Mar-19			-	*0.00*	-	*0.00*	
Apr-19			-	*0.00*	-	*0.00*	
May-19			-	*0.00*	-	*0.00*	
Jun-19			-	*0.00*	-	*0.00*	
Jul-19			-	*0.00*	-	*0.00*	
Aug-19			-	*0.00*	-	*0.00*	
Sep-19			-	*0.00*	-	*0.00*	
Oct-19			-	*0.00*	-	*0.00*	
Nov-19			-	*0.00*	-	*0.00*	
Dec-19			-	*0.00*	-	*0.00*	
Total-19			*0.00*	*$* -	*0.00*	*$* -	

Northern States Power Company
Electric Utility - State of Minnesota
Wind Curtailment Summary Report - Code 2 (Low Load)
For January 2017 to December 2019

Production Month	Date Paid		Wind Production Delivered		Lost Production		Total Xcel Energy Paid
	Delivered MWh	Lost MWh	MWh Delivered	Amount Xcel Energy Paid	Lost MWh	Amount Xcel Energy Paid	
Jan-17			-	*0.00*	-	*0.00*	
Feb-17			-	*0.00*	-	*0.00*	
Mar-17			-	*0.00*	-	*0.00*	
Apr-17			-	*0.00*	-	*0.00*	
May-17			-	*0.00*	-	*0.00*	
Jun-17			-	*0.00*	-	*0.00*	
Jul-17			-	*0.00*	-	*0.00*	
Aug-17			-	*0.00*	-	*0.00*	
Sep-17			-	*0.00*	-	*0.00*	
Oct-17			-	*0.00*	-	*0.00*	
Nov-17			-	*0.00*	-	*0.00*	
Dec-17			-	*0.00*	-	*0.00*	
Total-17			*0.00*	*$* -	*0.00*	*$* -	
Jan-18			-	*0.00*	-	*0.00*	
Feb-18			-	*0.00*	-	*0.00*	
Mar-18			-	*0.00*	-	*0.00*	
Apr-18			-	*0.00*	-	*0.00*	
May-18			-	*0.00*	-	*0.00*	
Jun-18			-	*0.00*	-	*0.00*	
Jul-18			-	*0.00*	-	*0.00*	
Aug-18			-	*0.00*	-	*0.00*	
Sep-18			-	*0.00*	-	*0.00*	
Oct-18			-	*0.00*	-	*0.00*	
Nov-18			-	*0.00*	-	*0.00*	
Dec-18			-	*0.00*	-	*0.00*	
Total-18			*0.00*	*$* -	*0.00*	*$* -	
Jan-19			-	*0.00*	-	*0.00*	
Feb-19			-	*0.00*	-	*0.00*	
Mar-19			-	*0.00*	-	*0.00*	
Apr-19			-	*0.00*	-	*0.00*	
May-19			-	*0.00*	-	*0.00*	
Jun-19			-	*0.00*	-	*0.00*	
Jul-19			-	*0.00*	-	*0.00*	
Aug-19			-	*0.00*	-	*0.00*	
Sep-19			-	*0.00*	-	*0.00*	
Oct-19			-	*0.00*	-	*0.00*	
Nov-19			-	*0.00*	-	*0.00*	
Dec-19			-	*0.00*	-	*0.00*	
Total-19			*0.00*	*$* -	*0.00*	*$* -	

Northern States Power Company
Electric Utility - State of Minnesota
Wind Curtailment Summary Report - Code 3 (MISO)
For January 2017 to December 2019

Production Month	Date Paid: Delivered MWh	Date Paid: Lost MWh	Wind Production Delivered: MWh Delivered	Wind Production Delivered: Amount Xcel Energy Paid	Lost Production: Lost MWh	Lost Production: Amount Xcel Energy Paid	Total Xcel Energy Paid
Jan-17			185,333.00	6,652,404.63	3,697.00	157,640.77	$ 6,810,045.40
Feb-17			186,522.00	7,471,418.20	6,934.00	276,825.34	$ 7,748,243.54
Mar-17			173,389.00	6,688,109.31	11,980.00	523,111.92	$ 7,211,221.23
Apr-17			208,551.00	8,133,830.65	7,291.00	309,809.33	$ 8,443,639.98
May-17			140,001.00	5,528,045.13	5,970.00	243,464.35	$ 5,771,509.48
Jun-17			142,504.00	5,704,337.23	6,822.00	309,043.74	$ 6,013,380.97
Jul-17			22,344.00	1,266,241.66	277.00	14,625.98	$ 1,280,867.64
Aug-17			22,910.00	1,180,091.68	54.00	2,734.06	$ 1,182,825.74
Sep-17			75,520.00	3,539,468.64	1,268.00	65,237.53	$ 3,604,706.17
Oct-17			109,037.00	5,029,142.90	2,931.00	133,307.49	$ 5,162,450.39
Nov-17			129,002.00	5,142,020.66	435.00	18,782.21	$ 5,160,802.87
Dec-17			97,506.00	4,362,695.93	479.00	16,365.01	$ 4,379,060.94
Total-17			1,492,619.00	$ 60,697,806.62	48,138.00	$ 2,070,947.73	$ 62,768,754.35
Jan-18			161,780.11	7,280,301.87	1,511.09	61,457.59	$ 7,341,759.46
Feb-18			113,091.36	5,536,884.67	233.23	10,491.35	$ 5,547,376.02
Mar-18			208,117.65	8,568,537.26	840.25	35,475.95	$ 8,604,013.21
Apr-18			152,131.99	7,033,848.29	2,458.29	108,258.95	$ 7,142,107.24
May-18			128,803.87	5,936,773.66	805.12	39,345.01	$ 5,976,118.67
Jun-18			164,397.54	7,366,182.11	956.44	37,717.50	$ 7,403,899.61
Jul-18			103,125.62	4,460,620.74	558.38	25,341.15	$ 4,485,961.89
Aug-18			112,300.16	5,084,272.85	564.99	26,170.63	$ 5,110,443.48
Sep-18			136,694.24	6,133,579.28	1,483.22	64,512.97	$ 6,198,092.25
Oct-18			55,002.98	2,166,371.84	392.86	18,908.20	$ 2,185,280.04
Nov-18			110,378.69	4,609,900.25	1,497.05	66,292.63	$ 4,676,192.88
Dec-18			157,458.72	6,744,439.49	10,741.09	338,305.25	$ 7,082,744.74
Total-18			1,603,282.93	$ 70,921,712.31	22,042.02	$ 832,277.18	$ 71,753,989.49
Jan-19			34,790.48	1,584,575.48	2,691.44	138,614.09	$ 1,723,189.57
Feb-19			46,095.81	1,975,647.30	1,755.04	84,703.94	$ 2,060,351.24
Mar-19			133,223.00	5,104,484.91	1,869.04	93,395.08	$ 5,197,879.99
Apr-19			132,374.40	5,618,629.76	15,514.36	714,235.19	$ 6,332,864.95
May-19			143,861.13	6,224,849.74	8,719.31	367,154.52	$ 6,592,004.26
Jun-19			103,936.66	4,463,954.31	2,914.02	116,848.22	$ 4,580,802.53
Jul-19			64,936.43	2,490,433.42	5,882.20	225,357.99	$ 2,715,791.41
Aug-19			65,097.85	2,490,144.14	1,705.60	68,807.54	$ 2,543,812.57
Sep-19			152,102.41	6,518,938.81	1,016.19	47,264.76	$ 6,566,203.57
Oct-19			192,968.52	8,558,704.45	11,579.78	477,171.98	$ 9,035,876.43
Nov-19			74,659.60	2,611,621.36	1,818.16	77,049.29	$ 2,688,670.65
Dec-19			135,153.03	5,868,631.62	1,527.30	70,126.80	$ 5,938,758.42
Total-19			1,279,199.30	$ 53,510,615.30	56,992.45	$ 2,480,729.40	$ 55,976,205.59

Northern States Power Company
Electric Utility - State of Minnesota
Wind Curtailment Summary Report - Code 4 (Other-Paid)
For January 2017 to December 2019

Production Month	Date Paid: Delivered MWh	Date Paid: Lost MWh	Wind Production Delivered: MWh Delivered	Wind Production Delivered: Amount Xcel Energy Paid	Lost Production: Lost MWh	Lost Production: Amount Xcel Energy Paid	Total Xcel Energy Paid
Jan-17			-	*0.00*	-	*0.00*	
Feb-17			-	*0.00*	-	*0.00*	
Mar-17			-	*0.00*	-	*0.00*	
Apr-17			-	*0.00*	-	*0.00*	
May-17			-	*0.00*	-	*0.00*	
Jun-17			-	*0.00*	-	*0.00*	
Jul-17			-	*0.00*	-	*0.00*	
Aug-17			-	*0.00*	-	*0.00*	
Sep-17			-	*0.00*	-	*0.00*	
Oct-17			-	*0.00*	-	*0.00*	
Nov-17			-	*0.00*	-	*0.00*	
Dec-17			-	*0.00*	-	*0.00*	
Total-17			*0.00*	*$ -*	*0.00*	*$ -*	
Jan-18			-	*0.00*	-	*0.00*	
Feb-18			-	*0.00*	-	*0.00*	
Mar-18			-	*0.00*	-	*0.00*	
Apr-18			-	*0.00*	-	*0.00*	
May-18			-	*0.00*	-	*0.00*	
Jun-18			-	*0.00*	-	*0.00*	
Jul-18			-	*0.00*	-	*0.00*	
Aug-18			-	*0.00*	-	*0.00*	
Sep-18			-	*0.00*	-	*0.00*	
Oct-18			-	*0.00*	-	*0.00*	
Nov-18			-	*0.00*	-	*0.00*	
Dec-18			-	*0.00*	-	*0.00*	
Total-18			*0.00*	*$ -*	*0.00*	*$ -*	
Jan-19			-	*0.00*	-	*0.00*	
Feb-19			-	*0.00*	-	*0.00*	
Mar-19			-	*0.00*	-	*0.00*	
Apr-19			-	*0.00*	-	*0.00*	
May-19			-	*0.00*	-	*0.00*	
Jun-19			-	*0.00*	-	*0.00*	
Jul-19			-	*0.00*	-	*0.00*	
Aug-19			-	*0.00*	-	*0.00*	
Sep-19			-	*0.00*	-	*0.00*	
Oct-19			-	*0.00*	-	*0.00*	
Nov-19			-	*0.00*	-	*0.00*	
Dec-19			-	*0.00*	-	*0.00*	
Total-19			*0.00*	*$ -*	*0.00*	*$ -*	

2018 – 2019 WIND CURTAILMENT REPORT

I. INTRODUCTION

The Commission's April 4, 2006 Order regarding curtailment payments to wind developers (Docket No. E999/AA-04-1279) requires the Company to provide in future AAA reports a projection of wind generation curtailment costs given existing and planned wind-generated energy purchases and transmission system needs. In compliance with the Commission's Order, this report provides a summary of the Company's experience regarding wind curtailment payments. The estimate of potential curtailment payments, and the assumptions used to develop our forecast, will be provided in our 2021 fuel forecast Petition to be filed on May 1, 2020. We previously discussed and provided our 2020 wind curtailment forecasting in our May 1, 2019 Petition in Docket No. E002/AA-19-293.

II. CURTAILMENT UPDATE

In past AAA Curtailment Reports, the Company has worked with the Department and made efforts to improve communications about the events and activity that cause wind generation curtailment. The Department's review and evaluation over the years has helped identify areas where our reports could be more descriptive of the reasons for wind curtailment and efforts made to minimize resulting costs. In addition, the Company continues to utilize initiatives to reduce curtailment which we believe are having a positive impact on curtailment or costs associated with curtailment. Examples include, where possible, scheduling transmission activities which can impact curtailment during low wind months.

The Company expects that some level of wind curtailment from Power Purchase Agreement (PPA) facilities will occur during the foreseeable future. The reasons driving the curtailment have shifted from primarily local transmission constraints on NSP's transmission system in southwest Minnesota to regional transmission system congestion on the MISO system. The regional congestion, which results in negative LMP, was the largest driver of curtailment during this reporting period. Additionally, the nature of transmission congestion is accentuated by the large concentration and increased level of wind facility operations in Minnesota, North Dakota, South Dakota and Iowa.

Significant transmission improvements in southwestern Minnesota and the region such as the CapX2020 transmission projects (CapX2020) and a number of MISO Multi-Value Projects (MVPs) are now in-service and will positively impact curtailment by reducing local congestion. However, the Company believes future curtailment in

this area will continue to occur because of regional congestion and the resulting negative LMP in the MISO energy market, along with transmission outages required for construction, maintenance or repair activities and wind generation projects going into service before all required transmission facilities are completed.

To better manage regional congestion, MISO and the industry utilize Dispatchable Intermittent Resources (DIRs), which provides better management of the wind resources. Under this system, a number of existing PPA wind facilities that are capable of operating as DIR, along with all new wind facilities, are registered with MISO as DIR. DIR facilities are given set point instructions every five minutes and rely on Automated Generation Control (AGC) technology, which automatically controls wind project output. DIR allows wind generators to be operated more like traditional generating facilities and, as a result, MISO is able to more quickly and accurately respond to system conditions.

Table 1 shows the existing PPA wind facilities associated with this report that are registered and operate as DIR.

Table 1
DIR PPA Facilities

Wind Project	MW
Fenton	200
Odell	200
Prairie Rose	200
MinnDakota	150
Mower County	100
Moraine II	50
Big Blue	36
Zephyr	30
Valley View	10
Total	976

The federal Production Tax Credit (PTC), which provides tax benefits to wind generating plants, is scheduled to expire over the next few years. As in the past, the uncertainty of PTC expiration is closely connected with increases in wind curtailment, since wind projects are often put into service to meet PTC eligibility requirements even though the necessary transmission upgrades were not completed. The Company

is aware of 5,500 MW of planned wind generation in Minnesota, North Dakota, South Dakota and Iowa that has recently gone into service, or is expected to go into service in in the next two years. This includes 1,800 MW of Company-owned and PPA wind. Table 2 shows planned wind developments by NSP and other regional companies. All of these wind developments will be registered and operated as DIRs.

Table 2
Wind Generation Additions[1]

Company	MW	Location	In-Service Date
NSP	1800	ND, SD, MN	2019-2021
Alliant Energy	1000	Iowa	2019-2020
Great River Energy	300	ND	2019-2020
MidAmerican	2000	Iowa	2019-2020
Minnesota Power	250	MN	2020
Ottertail Power	150	ND	2020
Total	5500		

The required transmission upgrades for these wind projects will likely not all be in-service by the time the projects begin producing energy. In addition, a number of transmission facilities that were identified in the interconnection studies as overloaded will be taken out of service and rebuilt.[2] This will have a negative effect on LMP pricing in the MISO energy market that could potentially impact real-time wind generation on the NSP System. This potential impact will lessen due to mitigation measures such as: (1) the use of DIR and set-point control technology, (2) placing in service the required transmission facilities and transmission system improvements, and (3) improved transmission outage scheduling.

III. Transmission System Improvements

Since 1994, wind energy resources have been the dominant factor in determining the need for transmission infrastructure improvements in southwestern Minnesota. To

[1] This does not include the wind repowering projects that NSP is pursueing.
[2] This is especially true in the area around Big Stone in South Dakota. A significant number of 115 kV and 230 kV lines, mostly owned by Otter Tail Power Company are being taken out of service and rebuilt. Xcel Energy will also be rebuilding an existing 345 kV that connects to the Twin Cities.

meet this need, the Company, often in cooperation with other utilities, has planned, engineered and constructed a number of projects designed to increase the transmission capacity in that area. Table 3 shows historic southwest Minnesota projects that increased the available transmission outlet in that area.

Table 3
Southwest Minnesota Wind Limits

Transmission Project	Transmission Owner	In-Service Date
425 MW Wind Transmission Expansion Project	Xcel Energy	December 2006
825 MW Wind Transmission Expansion Project	Xcel Energy	June 2008
Buffalo Ridge Incremental Generation Outlet (BRIGO)	Xcel Energy	December 2009

The Company also participated in the development of three CapX2020 transmission projects, all of which have gone into service and are helping reduce wind curtailment on the NSP system. Table 4 lists the CapX2020 transmission projects.

Table 4
CapX2020 Transmission Projects

Transmission Project	Transmission Owner	Actual/Planned In-Service Date
Brookings County - Southeast Twin Cities 345 kV Line	Xcel Energy, Great River Energy	March 26, 2015
Fargo North Dakota - Northwest Twin Cities 345 kV Line	Xcel Energy, Great River Energy	April 2, 2015
Southeast Twin Cities - LaCrosse, Wisconsin 345 kV Line	Xcel Energy, SMMPA and non-MISO	September 16, 2016

In addition to transmission projects developed by the Company, MISO has identified and approved a number of new transmission infrastructure projects, including 17 MVPs, designed to accommodate the planned and expected generation expansion in the MISO footprint.[3] The MVPs will help expand and enhance the region's transmission system, reduce congestion, provide access to affordable energy sources and meet public policy requirements including renewable energy mandates. The

[3] The MISO Board of Directors approved the new transmission projects, which included the CapX2020 Brookings County – Southeast Twin Citites 345 kV line as an MVP, on December 13, 2012.

completion of the MVP projects, particularly the ones listed in the following table, have had, or will have, a positive impact on Company-owned and PPA wind facilities.

Table 5
MVP Projects

Transmission Project	Transmission Owner	Planned/Actual In-Service Date
Big Stone South to Brookings County 345 kV Line	Ottertail Power Company, Xcel Energy	September 8, 2017
Lakefield Jct. - Winnebago - Winco - Kossuth County & Obrien County - Kossuth County - Webster 345 kV Line	MidAmerica Energy, ITC Midwest	September 27, 2018
North LaCrosse - North Madison	American Transmission Company, Xcel Energy	December 12, 2018
Winco to Hazleton 345 kV Line	MidAmerica Energy, ITC Midwest	July 18, 2019
Ellendale to Big Stone South 345 kV Line	Ottertail Power Company, Montana Dakota Utilities	February 5, 2019
North Madison - Cardinal - Spring Green - Dubuque area 345 kV Line	American Transmission Company, ITC Midwest	End 2023

IV. Wind Generation, Curtailment and Curtailment Projections

Chart 1 shows Company-owned and PPA wind generation facilities throughout the NSP service territory on an incremental and cumulative basis.

Chart 1
NSP Wind Development
(1993 – 2019)

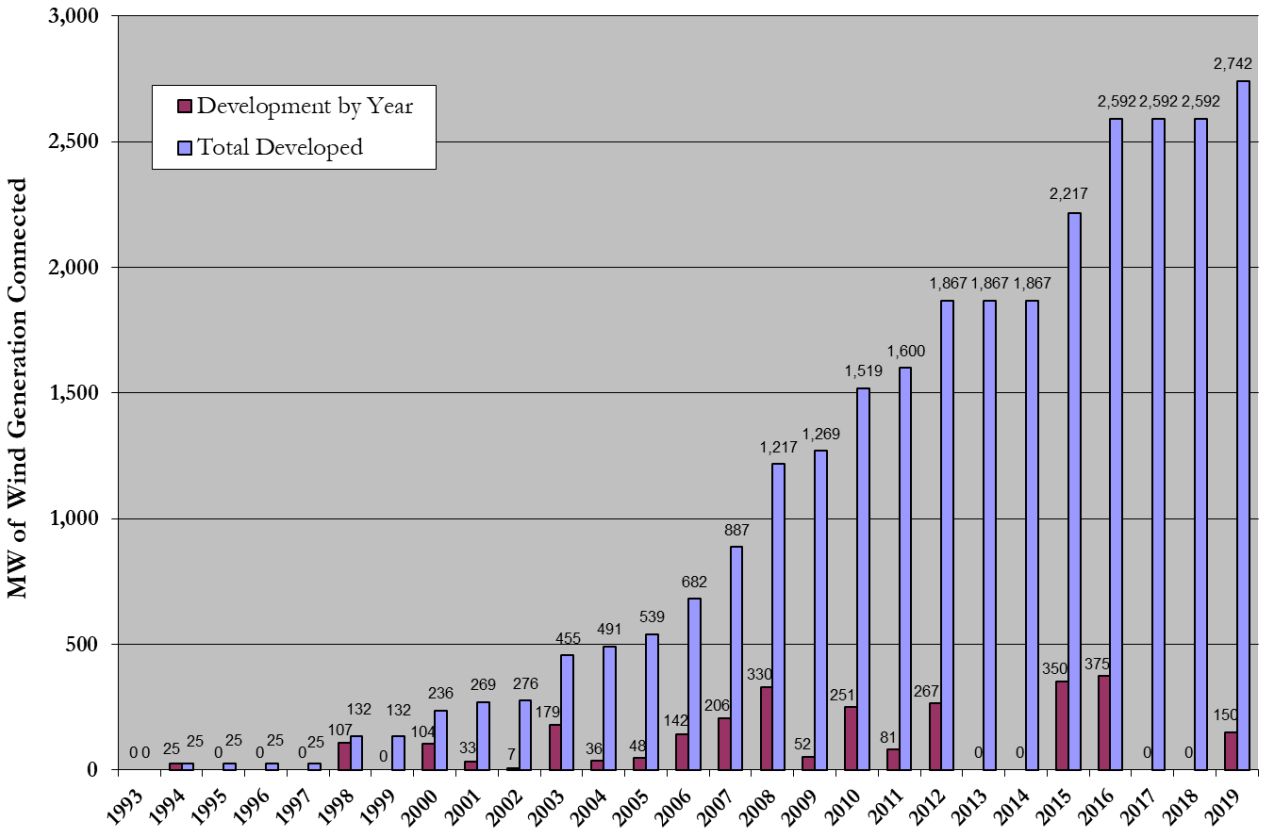
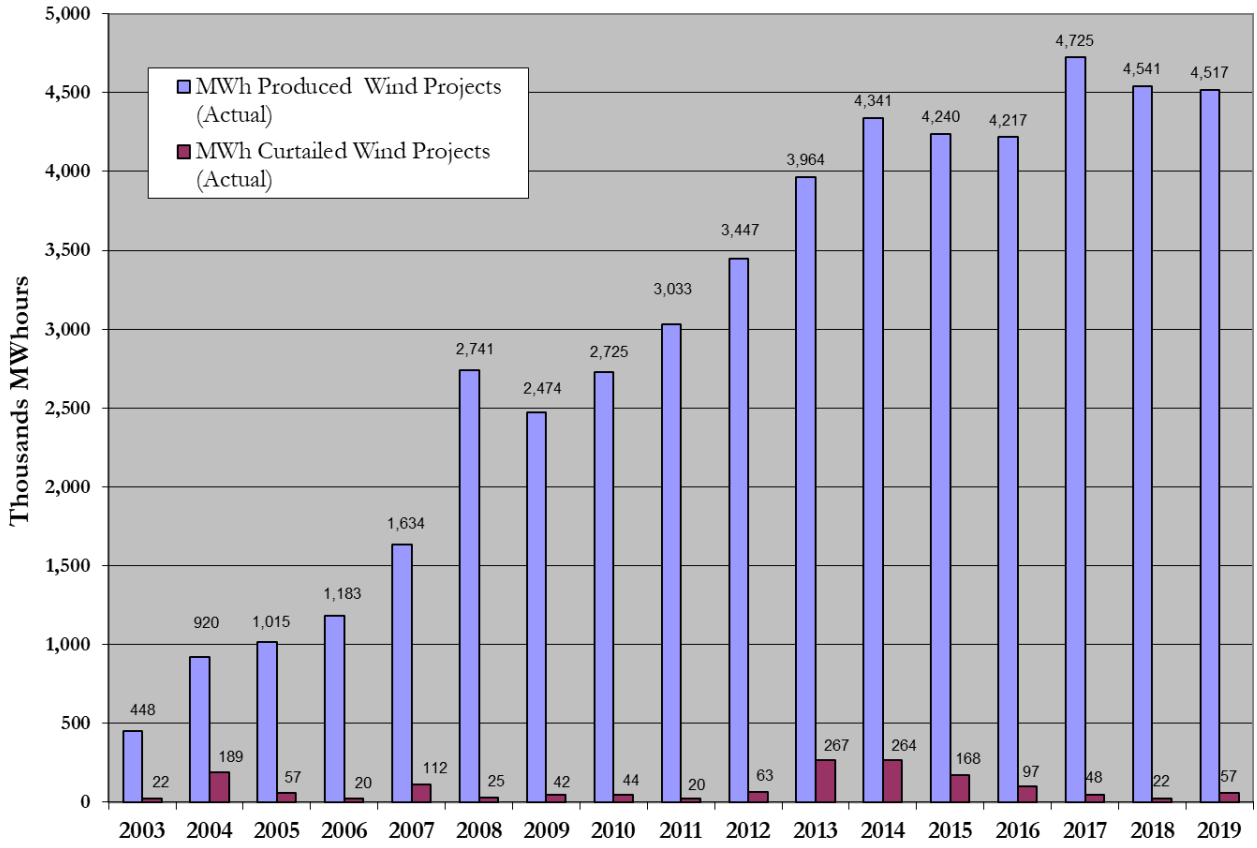


Chart 2 shows the comparison between total wind energy produced and the wind energy curtailed from the projects through December 2019[4]. Despite the lead/lag time associated with generation and transmission development, Chart 2 shows that wind curtailment is small compared to the total wind generation delivered.

Wind curtailment, as a tool to manage wind generation volumes when necessary, has had the positive benefit of facilitating a large amount of wind resources to be added to the system, which would not otherwise have been possible.

[4] AAA Part H, Section 5, Schedule 1.

Chart 2
NSP Wind Production & Curtailment (MWh)
(2003 – 2019)



Curtailment during July 2018 through December 2019 was broken up into two categories to better explain the reasons for the curtailment and its cause. To support the analysis the Company identified hours during the 2018/2019 AAA period where transmission-related outages impacted wind projects. These hours were assigned as Transmission Curtailment. During hours where transmission outages did not occur, or where transmission outages did not impact a specific wind farm, the hours were assigned as DIR Curtailment[5] based on if a project was registered as a DIR. This hourly information was then compared to hourly curtailment data for each of the reporting wind farms and total MWh and curtailment costs were calculated. It should be noted that the hourly data was only assigned one category and did not overlap.

[5] The Company stopped performing manual curtailment of non-DIR PPA wind facilities during the 2018/2019 AAA period since analysis of the economic impact of manual curtailment showed minimal customer economic value.

A total of $2,947,317 in curtailment payments[6] were made during this reporting period for the twocategories:

1) Transmission Curtailment Events ($610,781). This includes all outages listed below; and
2) DIR Curtailments Events ($2,336,535). This was driven by negative LMP related reasons

The MWh and curtailment costs determined during the curtailment analysis are compiled in Table 6 and Table 7 below. These results are further separated to show MWh and curtailment costs for projects that are still eligible for the PTC and those that are not. Note: the curtailment values in this section do not exactly match the curtailment values shown in AAA Part H, Section 5, Schedule 1. This data is based on the Company's analysis and estimated volumes from curtailment events and not based on the customer submitted invoices.

Table 6
2018/2019 Wind Curtailment MWh

Events	MWh		
	Total	Projects / No PTC	Projects / PTC
Transmission Events	19,116	19,116	0
DIR Curtailment Events	51,669	50,150	0
Totals	70,786	70,786	0

Table 7
2018/2019 Wind Curtailment Costs

Events	Payments		
	Total	Projects / No PTC	Projects / PTC
Transmission Events	$610,781	$610,781	$0
DIR Curtailment Events	$2,336,535	$2,252,324	$0
Totals	$2,947,317	$2,947,317	$0

[6] The curtailment analysis in this section used Company data – not AAA Part H, Section 5, Schedule 1 data.

As can be seen in Tables 6 and 7, the majority of the curtailment was related to DIR Curtailment Events and occurred at projects that are no longer eligible for the PTC.

It is important to note that of the $2,947,317 in total curtailment costs, the vast majority of these total costs are associated with the contractual energy price of the PPAs. These are contractually obligated sunk costs which are not economically relevant to the decision to curtail the generation from a wind farm.[7]

Transmission Curtailment Events

Wind curtailment costs totaling $610,781 were due to the transmission events described below.

The primary goal when planning construction and maintenance work that will impact wind generation output is to perform multiple outages at the same time, and schedule these activities during times when wind is normally at its lowest levels – typically the summer months in the NSP service territory. While Xcel Energy attempts to plan outage work with this principle in mind, this is not always possible. For example, from September through the end of 2013, there were unavoidable transmission outages taken which resulted in significantly increased levels of curtailment than had been experienced in a number of years. Summer months are also high load months and transmission outages may not be possible due to load serving needs.

It should be noted that only specific wind generation facilities are used to manage the different transmission events. For example, a Split Rock – Nobles County 345 kV line outage could be managed by limiting output of Lake Benton II, Chanarambie Power Partners, Fenton, Ridgewind, Moraine I, and/or Moraine II while a Brookings County transformer outage could be managed by limiting output of MinnDakota.

The Company experienced planned and unplanned outages of the Split Rock – Nobles County 345 kV line, Nobles County Lakefield Junction 345 kV line, Chanarambie – Fenton 115 kV line, Fenton – Nobles County 115 kV line and Brookings County TR10 Transformer that contributed to curtailment during this period. The facilities were taken out of service as the result of adverse weather conditions, for NSP and other utility maintenance activies, and to accommodate upgrades related to interconnecting new generating facilities.

[7] The PPA contract language can generally be described as "take or pay" in which NSP must pay for the wind energy that could be produced, regardless of whether it actually is produced or if it is curtailed.

Curtailment Procedures

MISO performs a 10-minute forecast every five minutes which is used as the maximum limit for the wind farm in the Unit Dispatch System. MISO sends five-minute dispatch instructions to DIR wind farms. When LMP drops below the offer price of the DIR unit, the farm is automatically dispatched down. The setpoint is sent to the DIR wind farm, and the facility is automatically curtailed. It should be noted that not all DIR farms are equipped with setpoint controls. In such situations, a phone call or e-mail is required to initiate a DIR curtailment. Non-DIR units are not equipped with setpoint control.

DIR Curtailment Events

Wind curtailment costs totaling $2,336,535 were due to the MISO-directed DIR control as described below.

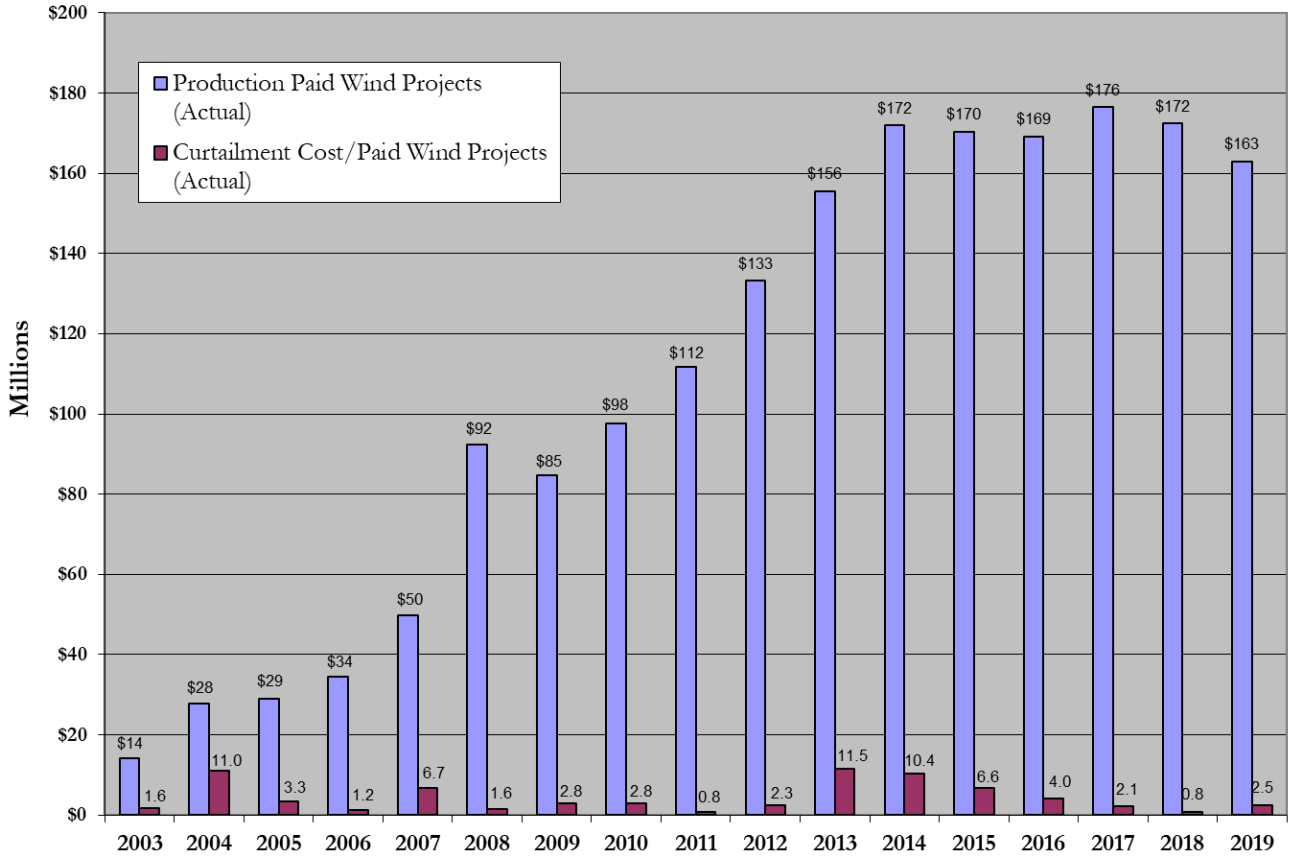
DIR related curtailment was due to negative LMP prices associated with congestion throughout the Minnesota and Iowa region due to regional transmission outages, or local congestion due to local transmission outages, as well as the higher levels of wind generation present where all required transmission improvements have not been completed or where sufficient transmission outlets did not exist.

Both PTC and non-PTC DIR wind farms are managed by MISO through automatic control, and these facilities are required to comply with the MISO cost signals. Failure to comply would expose the Company to Revenue Sufficiency Guarantee charges.

V. Wind Production and Curtailment Payments

Chart 3 shows the corresponding production and curtailment costs from July 1, 2018 through December 30, 2019.[8] As with wind generation produced and curtailed, paid curtailment is a very small portion of total cost of wind generation on the system.

Chart 3
NSP Wind Production & Curtailment Payments
(2003 – 2019)



The Company has typically provided estimates of future potential curtailment payment estimates in the AAA Report. However, going forward these estimates will be provided in our fuel forecast Petition, including the one that will be filed on May 1, 2020. The Company is projecting future curtailment will occur because of regional congestion and the resulting negative LMP in the MISO energy market, along with transmission outages required for construction, maintenance or repair activities and

[8] AAA Part H, Section 5, Schedule 1

wind generation projects going into service before all required transmission facilities are completed.

Future wind generation additions and completion of the MVP transmission projects will likely impact the amount of future curtailment experienced. While it is reasonable to expect curtailment levels will be reduced once the new transmission lines are in service, the reduction will likely be off-set by the new wind projects going into service. In the Company's recent filing for Acquisition of Wind Generation under Docket No. E002/M-16-777, a detailed discussion on wind curtailment was also provided. The filing stated that the Company expects wind curtailment to be higher when the new projects first go into service, and then decline as new transmission and other changes on the MISO system occur to better accommodate increased wind penetration. While we continue to believe that this will be the case, there is no certainty as to when, and if, the numerous wind generation projects currently in the development queue will actually come to fruition.

VI. CONCLUSION

The Company anticipates that wind generation curtailment and associated payment to vendors will continue to occur over the coming years because of regional congestion and the resulting negative LMP in the MISO energy market, along with transmission outages required for construction, maintenance or repair activities and wind generation projects going into service before all required transmission facilities are completed. System conditions and wind project development are very dynamic and actual curtailment may vary from that projected in this report. The Company will continue to participate in discussions regarding transmission planning and operations to identify needs and work to manage future costs. We will continue to refine and gather information for use in future updates to be submitted with subsequent AAA reports.