MONTANA-DAKOTA
UTILITIES CO.
A Division of MDU Resources Group, Inc.

400 North Fourth Street
Bismarck, ND 58501
(701) 222-7900

October 7, 2015

Mr. Will Rosquist
Utility Division
Montana Public Service Commission
1701 Prospect Avenue
Helena, MT 59620

Re: General Electric Rate Application
Docket No. D2015.6.51

Dear Ms. Whitney:

Enclosed please find Montana-Dakota Utilities Co.'s responses to the Montana Public Service Commission data request dated August 20, 2015.

Sincerely,

Tamie A. Aberle
Director of Regulatory Affairs

Attachments
cc: Service List

Montana-Dakota Utilities Co.
Docket No. D2015.6.51
Service List

Mr. Will Rosquist
Utility Division
Montana Public Service Commission
1701 Prospect Avenue
PO Box 202601
Helena, MT 59620-2601
kwhitney@mt.gov

Robert Nelson
Monica Tranel
Montana Consumer Counsel
111 N. Last Chance Gulch, Suite 1B
PO Box 201703
Helena, MT 59620-1703
robnelson@mt.gov
mtranel@mt.gov

Mike Green
900 N. Last Chance Gulch
Suite 200
Helena, MT 59601
mgreen@crowleyfleck.com

Charles Magraw
501 8th Ave
Helena, MT 59601
c.magraw@bresnan.net

Thorvald A. Nelson
Holland & Hart LLP
6380 South Fiddlers Green Circle
Suite 500
Greenwood Village, CO 80111
tnelson@hollandhart.com

David Wooley
Keyes, Fox & Wiedman LLP
436 14th Street, Suite 1305
Oakland, CA 94612
dwooley@kfwlaw.com

Nikolas S. Stoffel
Holland & Hart LLP
6380 South Fiddlers Green Circle
Suite 500
Greenwood Village, CO 80111
nsstoffel@hollandhart.com

Kelly Crandall
Keyes, Fox & Wiedman LLP
1400 16th St
16 Market Square, Suite 400
Denver, CO 80202
kcrandall@kfwlaw.com

Albert Clark
142 Buccaneer Drive
Leesburg, GL 34788
aclark154@yahoo.com

Jack Pous
14 Shell Avenue SE
Ft. Walton Beach, FL 32548
jpous@ducinc.net

John Wilson
J W Wilson & Associates Inc.
1601 N. Kent Street, Suite 1104
Arlington, VA 22209-2105
john@jwwa.com

Electronic Service Only:
ppenn@hollandhart.com
aclee@hollandhart.com
crmayers@hollandhart.com

MONTANA-DAKOTA UTILITIES CO.
MONTANA PUBLIC SERVICE COMMISSION
DATA REQUEST
DATED AUGUST 20, 2015
DOCKET NO. D2015.6.51

PSC-004

Regarding: Net Metering
Witness: Aberle

a. **For each net metering customer/system currently within MDU's Montana service territory, please complete the following table (add rows for additional systems):**

System No.	Customer segment (residential, commercial)	Type (solar PV, wind, etc.)	System capacity (KW)	System location	Date connected to MDU system
1					
2					
3					
4					

b. **Please provide a monthly bill history (total bill amount and billed net kWh) for each net metered customer for the past three years or, if a three-year history is not available, the longest period available.**

c. **Please provide the expected energy output for each net metered system for each month of the year and indicate whether the expected energy is based on actual sample data or system modeling.**

d. **Please provide any load research information MDU has that compares typical usage profiles (energy and demand use) of net metered customers and non-net metered customers, by customer segment.**

Response:

a.

System No.	Customer segment (residential, commercial)	Type (solar PV, wind, etc.)	System capacity (KW)	System location	Date connected to MDU system
1	Residential	Wind	1.0	Miles City	6/17/09
2	Residential	Wind	1.0	Miles City	7/8/09
3	Small General	Wind	2.4	Wolf Point	7/9/10
4	Small General	Wind	2.4	Forsyth	7/9/10

b. Please see Attachment A.

c. Montana-Dakota does not have information available regarding the net energy output for each customer.

d. Montana-Dakota does not have sufficient net metering customers to provide a valid comparison between customers that have a generator installed and are utilizing net metering and those that do not.

Montana-Dakota Utilities
Electric Utility - Montana
Net Metering - 3 Year History

	Rate 10 Customer #1			Total Bill
	Delivered	Received	Net	(excl USBC)
January 2012	842	0	842	$65.12
February	1,504	0	1,504	111.98
March	1,414	0	1,414	105.31
April	909	0	909	70.06
May	823	0	823	63.93
June	1,052	0	1,052	82.40
July	1,053	0	1,053	98.27
August	1,774	0	1,774	162.08
September	1,196	0	1,196	112.34
October	1,194	0	1,194	111.44
November	1,087	0	1,087	85.35
December	1,648	0	1,648	126.31
January 2013	1,802	0	1,802	136.54
February	1,373	0	1,373	102.77
March	1,409	0	1,409	107.67
April	1,343	0	1,343	104.85
May	1,009	0	1,009	79.22
June	857	0	857	70.07
July	1,109	0	1,109	106.78
August	1,464	0	1,464	138.74
September	1,367	0	1,367	130.51
October	1,216	0	1,216	114.25
November	1,201	0	1,201	95.33
December	1,604	0	1,604	125.41
January 2014	1,829	0	1,829	143.06
February	1,455	0	1,455	113.76
March	1,918	0	1,918	150.57
April	1,503	0	1,503	120.32
May	1,567	0	1,567	126.72
June	901	0	901	77.14
July	984	0	984	98.36
August	1,207	0	1,207	118.08
September	1,021	0	1,021	99.13
October	818	0	818	77.69
November	577	0	577	47.24
December	1,765	0	1,765	134.53

Montana-Dakota Utilities
Electric Utility - Montana
Net Metering - 3 Year History

	Rate 10 Customer #2			Total Bill
	Delivered	Received	Net	(excl USBC)
January 2012	3,263	0	3,263	$237.27
February	2,962	0	2,962	214.48
March	2,845	0	2,845	206.56
April	3,208	0	3,208	235.01
May	2,658	0	2,658	193.73
June	1,383	0	1,383	101.25
July	1,056	0	1,056	97.97
August	1,942	0	1,942	177.01
September	1,090	0	1,090	101.81
October	1,409	0	1,409	134.50
November	1,066	0	1,066	83.87
December	3,225	0	3,225	241.21
January 2013	4,883	0	4,883	361.85
February	4,705	0	4,705	340.11
March	3,631	0	3,631	267.63
April	3,380	0	3,380	254.19
May	3,211	0	3,211	242.20
June	2,446	0	2,446	187.33
July	791	0	791	76.94
August	1,329	0	1,329	126.53
September	1,141	0	1,141	109.27
October	1,423	0	1,423	137.55
November	1,767	0	1,767	138.21
December	2,952	0	2,952	226.42
January 2014	4,162	0	4,162	317.53
February	3,217	0	3,217	244.65
March	4,119	0	4,119	316.31
April	2,522	0	2,522	198.55
May	1,953	0	1,953	156.37
June	1,602	0	1,602	128.11
July	1,834	0	1,834	176.77
August	785	0	785	78.76
September	1,319	0	1,319	126.67
October	1,107	0	1,107	107.13
November	961	0	961	75.86
December	2,187	0	2,187	165.61

Montana-Dakota Utilities
Electric Utility - Montana
Net Metering - 3 Year History

	Rate 20 Customer #1			Total Bill
	Delivered	Received	Net	(excl USBC)
January 2012	1,558	7	1,551	91.61
February	1,497	13	1,484	88.09
March	1,439	6	1,433	86.05
April	844	69	775	53.63
May	766	117	649	48.83
June	626	72	554	41.65
July	243	138	105	22.90
August	371	85	286	36.75
September	480	47	433	46.83
October	573	31	542	51.86
November	470	41	429	39.41
December	1,555	10	1,545	95.40
January 2013	1,652	1	1,651	99.40
February	2,622	5	2,617	151.80
March	620	7	613	38.16
April	1,694	2	1,692	102.41
May	1,805	31	1,774	108.15
June	399	30	369	34.69
July	532	15	517	52.36
August	422	0	422	44.67
September	445	0	445	45.28
October	507	0	507	53.08
November	310	0	310	31.51
December	2,809	0	2,809	166.97
January 2014	2,684	0	2,684	156.15
February	3,436	0	3,436	193.77
March	3,601	0	3,601	207.14
April	2,585	0	2,585	157.17
May	1,728	0	1,728	110.54
June	781	0	781	58.63
July	410	0	410	46.03
August	289	0	289	36.47
September	534	0	534	52.22
October	348	0	348	41.77
November	510	0	510	41.19
December	2,365	0	2,365	137.19

Montana-Dakota Utilities
Electric Utility - Montana
Net Metering - 3 Year History

	Rate 20 Customer #2			Total Bill
	Delivered	Received	Net	(excl USBC)
January 2012	620	9	611	47.89
February	1,238	0	1,238	74.81
March	759	0	759	55.34
April	342	0	342	31.79
May	293	0	293	29.64
June	304	0	304	35.53
July	249	0	249	31.73
August	165	0	165	29.05
September	407	0	407	43.36
October	346	12	334	34.50
November	834	6	828	61.33
December	794	8	786	54.94
January 2013	1,616	1	1,615	95.23
February	1,215	3	1,212	74.81
March	1,583	6	1,577	95.34
April	808	20	788	58.74
May	1,002	4	998	66.72
June	293	29	264	29.82
July	408	11	397	44.57
August	258	4	254	33.37
September	298	2	296	35.94
October	545	8	537	51.11
November	707	8	699	52.42
December	1,379	0	1,379	87.91
January 2014	1,956	6	1,950	121.59
February	1,463	0	1,463	91.30
March	1,422	6	1,416	93.38
April	872	14	858	62.28
May	719	17	702	53.31
June	487	29	458	47.37
July	383	6	377	43.56
August	371	2	369	41.37
September	601	0	601	57.99
October	672	5	667	55.69
November	721	10	711	50.83
December	1,219	9	1,210	78.98

MONTANA-DAKOTA UTILITIES CO.
MONTANA PUBLIC SERVICE COMMISSION
DATA REQUEST
DATED AUGUST 20, 2015
DOCKET NO. D2015.6.51

PSC-005

Regarding: Net Metering
Witness: Aberle

a. **Please estimate the monthly bill impact of MDU's proposed demand charge on current net metered customers and provide the results along with supporting work papers.**

b. **Under MDU's proposal to impose a demand charge on net metering customers, would the demand charge apply to both existing and prospective net metering customers, or would existing net metering customers be grandfathered?**

c. **Please estimate the test year revenue reduction attributable to the sales reductions from net metered customer generation and provide the results along with supporting work papers.**

d. **Please identify and quantify all costs MDU avoids when a customer chooses to generate a portion of their annual electricity consumption with: i) a solar PV system and ii) a wind power facility. Please provide supporting work papers.**

e. **Please identify and quantify the direct administrative costs of implementing net metering on a per-customer basis for: i) residential customers and ii) commercial customers. Please provide supporting work papers.**

Response:

a. Please see Attachment A.

b. Montana-Dakota would expect to charge the demand charge on a prospective basis and would grandfather the existing customers. This proposal should have been addressed on the tariff sheet.

c. Montana-Dakota does not have sufficient data available to estimate the revenue reduction. In order to do so accurately metering would be required at the customer's generator.

d. Montana-Dakota avoids the variable energy produced by the solar or wind power facility. Based on the currently effective avoided energy

costs this equates to 3.805 cents/Kwh during on-peak hours and 2.723 cents/Kwh during off- peak hours.

e. The direct administrative costs are minimal at this time because Montana-Dakota is monitoring only four customers.

MONTANA-DAKOTA UTILITIES CO.
ELECTRIC UTILITY - MONTANA
Bill Comparison Annual Effects
Residential Electric Service Rate 105 - Secondary Demand

Current Rate 105	
Base Rate	$0.18
Energy Charge	
Summer	0.06813
Winter	0.04816
Fuel Charge	0.02558

Proposed Rate 105	
Base Rate	$0.25
Energy Charge	
Summer	0.08381
Winter	0.06384
Fuel Charge	0.02558
Demand Charge	1.50

Customer #2

Month	Kwh	Energy	BSC	F&PP	Total
1	4,162	$ 200.44	$5.47	$106.46	$ 312.37
2	3,217	154.93	5.47	82.29	242.69
3	4,119	198.37	5.47	105.36	309.20
4	2,522	121.46	5.47	64.51	191.44
5	1,953	94.06	5.47	49.96	149.49
6	1,602	109.14	5.47	40.98	155.59
7	1,834	124.95	5.47	46.91	177.33
8	785	53.48	5.47	20.08	79.03
9	1,319	89.86	5.47	33.74	129.07
10	1,107	53.31	5.47	28.32	87.10
11	961	46.28	5.47	24.58	76.33
12	2,187	105.33	5.47	55.94	166.74
	25,768	$1,351.61	$65.64	$659.13	$2,076.38

Customer #1

1	1,829	88.08	5.47	46.79	140.34
2	1,455	70.07	5.47	37.22	112.76
3	1,918	92.37	5.47	49.06	146.90
4	1,503	72.38	5.47	38.45	116.30
5	1,567	75.47	5.47	40.08	121.02
6	901	61.39	5.47	23.05	89.91
7	984	67.04	5.47	25.17	97.68
8	1,207	82.23	5.47	30.88	118.58
9	1,021	69.56	5.47	26.12	101.15
10	818	39.39	5.47	20.92	65.78
11	577	27.79	5.47	14.76	48.02
12	1,765	85.00	5.47	45.15	135.62
	15,545	$830.77	$65.64	$397.65	$1,294.06

Customer #2

Month	Kwh	KW	Energy	BSC	F&PP	Demand	Total
1	4,162	5.1	$ 265.70	$7.60	$106.46	$7.65	$ 387.41
2	3,217	11.3	205.37	7.60	82.29	16.95	312.21
3	4,119	0.0	262.96	7.60	105.36	0.00	375.92
4	2,522	0.3	161.00	7.60	64.51	0.45	233.56
5	1,953	3.0	124.68	7.60	49.96	4.50	186.74
6	1,602	2.2	134.26	7.60	40.98	3.30	186.14
7	1,834	3.4	153.71	7.60	46.91	5.10	213.32
8	785	6.6	65.79	7.60	20.08	9.90	103.37
9	1,319	1.0	110.55	7.60	33.74	1.50	153.39
10	1,107	4.8	70.67	7.60	28.32	7.20	113.79
11	961	4.0	61.35	7.60	24.58	6.00	99.53
12	2,187	3.4	139.62	7.60	55.94	5.10	208.26
	25,768	45.1	$1,755.66	$91.20	$659.13	$67.65	$2,573.64

Customer #1

1	1,829	2.7	$ 116.76	$7.60	$46.79	$4.05	175.20
2	1,455	1.3	92.89	7.60	37.22	1.95	139.66
3	1,918	0.2	122.45	7.60	49.06	0.30	179.41
4	1,503	0.4	95.95	7.60	38.45	0.60	142.60
5	1,567	0.4	100.04	7.60	40.08	0.60	148.32
6	901	0.1	75.51	7.60	23.05	0.15	106.31
7	984	0.1	82.47	7.60	25.17	0.15	115.39
8	1,207	0.1	101.16	7.60	30.88	0.15	139.79
9	1,021	0.2	85.57	7.60	26.12	0.30	119.59
10	818	0.0	52.22	7.60	20.92	0.00	80.74
11	577	0.4	36.84	7.60	14.76	0.60	59.80
12	1,765	0.3	112.68	7.60	45.15	0.45	165.88
	15,545	6.2	$1,074.54	$91.20	$397.65	$9.30	$1,572.69

			Bill @			
Acct No	Kwh	KW	Current	Proposed	$ Change	% Change
Customer #2	25,768	45.1	2,076.38	2,573.64	497.26	23.95%
Customer #1	15,545	6.2	1,294.06	1,572.69	278.63	21.53%

Response No. PSC-005
Attachment A
Page 1 of 2

MONTANA-DAKOTA UTILITIES CO.
ELECTRIC UTILITY - MONTANA
Bill Comparison Annual Effects
Small General Electric Service Rate 205 - Secondary Demand

Current Rate 200 - Secondary	
Base Rate	$0.54
Energy Charge	
Summer	0.04457
Winter	0.02577
Fuel Charge	0.02558

Proposed Rate 200 - Secondary	
Base Rate	$0.65
Energy Charge	
Summer	0.05775
Winter	0.03895
Fuel Charge	0.02558
Demand Charge	
First 10 KW	0.00
Summer	10.00
Winter	9.25

Current Rates

Acct	Month	Kwh	Energy	Fuel	BSC	Total
205-1	1	1,956	50.41	50.03	16.42	116.86
	2	1,463	37.70	37.42	16.42	91.54
	3	1,422	36.64	36.37	16.42	89.43
	4	872	22.47	22.31	16.42	61.20
	5	719	18.53	18.39	16.42	53.34
	6	487	21.71	12.46	16.42	50.59
	7	383	17.07	9.80	16.42	43.29
	8	371	16.54	9.49	16.42	42.45
	9	601	26.79	15.37	16.42	58.58
	10	672	17.32	17.19	16.42	50.93
	11	721	18.58	18.44	16.42	53.44
	12	1,219	31.41	31.18	16.42	79.01
		10,886	315.17	278.45	197.04	790.66

Proposed Rates

Acct	Kwh	KW 1/	Energy	Fuel	Demand	BSC	Total
205-1	1,956	4.4	76.19	50.03	0.00	16.42	142.64
	1,463	3.1	56.98	37.42	0.00	16.42	110.82
	1,422	3.4	55.39	36.37	0.00	16.42	108.18
	872	1.8	33.96	22.31	0.00	16.42	72.69
	719	1.7	28.01	18.39	0.00	16.42	62.82
	487	1.4	28.12	12.46	0.00	16.42	57.00
	383	0.9	22.12	9.80	0.00	16.42	48.34
	371	1.0	21.43	9.49	0.00	16.42	47.34
	601	1.8	34.71	15.37	0.00	16.42	66.50
	672	1.7	26.17	17.19	0.00	16.42	59.78
	721	1.5	28.08	18.44	0.00	16.42	62.94
	1,219	2.3	47.48	31.18	0.00	16.42	95.08
	10,886	25	458.64	278.45	0.00	197.04	934.13

Current Rates

Acct	Month	Kwh	Energy	Fuel	BSC	Total
205-2	1	2,684	69.17	68.66	16.42	154.25
	2	3,436	88.55	87.89	16.42	192.86
	3	3,601	92.80	92.11	16.42	201.33
	4	2,585	66.62	66.12	16.42	149.16
	5	1,728	44.53	44.20	16.42	105.15
	6	781	34.81	19.98	16.42	71.21
	7	410	18.27	10.49	16.42	45.18
	8	289	12.88	7.39	16.42	36.69
	9	534	23.80	13.66	16.42	53.88
	10	348	8.97	8.90	16.42	34.29
	11	510	13.14	13.05	16.42	42.61
	12	2,365	60.95	60.50	16.42	137.87
		19,271	534.49	492.95	197.04	1,224.48

Proposed Rates

Acct	Kwh	KW 1/	Energy	Fuel	Demand	BSC	Total
205-2	2,684	6.1	104.54	68.66	0.00	16.42	189.62
	3,436	7.4	133.83	87.89	0.00	16.42	238.14
	3,601	8.5	140.26	92.11	0.00	16.42	248.79
	2,585	5.5	100.69	66.12	0.00	16.42	183.23
	1,728	4.2	67.31	44.20	0.00	16.42	127.93
	781	2.3	45.10	19.98	0.00	16.42	81.50
	410	1.0	23.68	10.49	0.00	16.42	50.59
	289	0.7	16.69	7.39	0.00	16.42	40.50
	534	1.6	30.84	13.66	0.00	16.42	60.92
	348	0.9	13.55	8.90	0.00	16.42	38.87
	510	1.0	19.86	13.05	0.00	16.42	49.33
	2,365	4.5	92.12	60.50	0.00	16.42	169.04
	19,271	44	788.47	492.95	0.00	197.04	1,478.46

		Bill @			
Acct No	Kwh	Current	Proposed	$ Change	% Change
Customer #2	10,886	790.66	934.13	143.47	18.15%
Customer #1	19,271	1,224.48	1,478.46	253.98	20.74%

1/ Estimated

Response No. PSC-005
Attachment A
Page 2 of 2

MONTANA-DAKOTA UTILITIES CO.
MONTANA PUBLIC SERVICE COMMISSION
DATA REQUEST
DATED AUGUST 20, 2015
DOCKET NO. D2015.6.51

PSC-006

Regarding: Net metering
Witness: Aberle

a. **The Statement L work papers, p. L-21, show a cost of about $271 per meter for residential net metering customers. The work papers also show a cost of about $88 per meter for non-net metered residential customers. Did MDU consider separately metering residential net metering customers' generators with standard kWh meters as an alternative to the demand meter proposal? If so, please provide the analysis and rationale for the decision to propose demand metering and a demand charge.**

b. **Has MDU considered the pros and cons of implementing a feed-in tariff for accommodating distributed, customer-owned, generation? If so, please provide MDU's analysis and summarize its conclusions.**

c. **Does MDU believe it would be reasonable and cost-effective to implement demand metering for all residential customers? Please explain why or why not.**

d. **If MDU were to design the Residential Electric Service Rate 10 tariff schedule as a three part tariff using the proposed Basic Service Charge of $0.25 per day and the $1.50 per KW-mo. demand charge proposed for net metering customers, what would the resulting energy charges be?**

e. **Please explain why MDU believes it is reasonable to charge residential net metering customers both the $1.50 per KW-mo. demand charge and the same energy rates as non-net metering residential customers.**

Response:

a. Separately metering the generator would not address the issue associated with customers causing a demand on the system and not adequately paying for the costs associated with that demand.

b. Montana-Dakota has not analyzed the pros and cons of implementing a feed-in tariff. The proposed demand charge is an attempt to address the issues associated with the net metering tariff Montana-Dakota was required to implement.

c. Implementing demand metering for all residential customers would significantly increase the residential rate. The installed cost of the traditional residential, kWh only, meter is $88. For demand metering, a more complex meter is required and would raise the installed cost to about $270. Montana-Dakota is proposing to utilize network data available through the current automated meter reading system for the net metering residential customers. This would not be currently feasible for the entire residential class at this time.

d. The energy rate would be as follows based on an average demand of 28.195 Kw per residential customer:

Residential Service	Billing Determinants	Proposed Rates Rate		Revenue
Basic Service Charge	20,064	0.25	per day	$1,830,840
Demand Charge	565,754	1.50	per Kw	848,631
Energy				
Summer	59,585,924	$0.07946	per Kwh	$4,734,698
Winter	135,654,617	$0.05949	per Kwh	$8,070,093
	195,240,541			12,804,791
Base Fuel	195,240,541	$0.02558	per Kwh	4,994,253
Total Rate 10				$20,478,515

e. It is reasonable to charge the net metering customers the same energy rate as the net metering customers are avoiding the cost of the energy delivered when credits are carried forward to future months.

MONTANA-DAKOTA UTILITIES CO.
MONTANA PUBLIC SERVICE COMMISSION
DATA REQUEST
DATED AUGUST 20, 2015
DOCKET NO. D2015.6.51

PSC-007
Regarding: Net metering
Witness: Aberle

Please provide any analysis MDU has conducted that demonstrates that proposed Rate 92 tariff schedule reasonably compensates net metered customers for the value of energy and capacity services provided to the Company.

Response:

The demand charge component recognizes that fixed costs are not fully recovered from the net customers. Net metering customers continue to be paid the full retail rate for energy carried forward to future months.

MONTANA-DAKOTA UTILITIES CO.
MONTANA PUBLIC SERVICE COMMISSION
DATA REQUEST
DATED AUGUST 20, 2015
DOCKET NO. D2015.6.51

PSC-008
Regarding: Net metering
Witness: Aberle

a. **Regarding the proposed Rate 92 tariff schedule, please provide a copy of the interconnection standards referred to in paragraph 1 in the General Terms and Conditions.**

b. **Regarding the proposed Rate 92 tariff schedule, please describe the circumstances under which MDU would require two meters for net metering.**

c. **Regarding the proposed Rate 92 tariff schedule, please describe the circumstances under which connection of the output directly to the Company's system would be the preferred approach to establishing interconnection for net metered generators.**

d. **Please explain whether and how the two meter configuration would account for any billing demand reduction attributable to the customer's generator.**

e. **Regarding the proposed Rate 92 tariff schedule, please explain what is included in "all costs associated with necessary distribution/metering system modification directly resulting from the installation and interconnection of the customer's generators." Specifically, please clarify whether these costs include the cost of the meter(s).**

Response:

a. Please see Attachment A.

b. With size of the generator limited to 50 kW in Rate 92, generally, there would not be a need for two meters (one a generator and one at custody point). A one meter scenario, measuring both delivered and received, would be the most common. But if the generator has significant impact on the operation and reliability of the distribution system, a two meter scenario may be required.

c. In the interest of safety to Company utility workers and reliable operation of the Company distribution system, connection of the generator outputs directly to Company's system may be the preferred approach in some cases.

d. In order to account for billing demand reduction, MDU would have to install complex load profile metering at custody point and at the generator. This scenario would significant increase metering cost and likely not economic for the customer.

e. The "all costs associated...." does not include the cost of the meter. With size of the generator limited to 50 kW under Rate 92, generally, there would not be distribution/metering system modifications and therefore no cost to customer. However, if safety and reliability of the distribution system is compromised, there may be a cost to the customer.

Response No. PSC-008
Attachment A

MONTANA-DAKOTA UTILITIES

REQUIREMENTS FOR GENERATION, TRANSMISSION, AND END-USER FACILITY INTERCONNECTIONS

Table of Contents

I. Introduction

A. Authority

State and Federal regulatory agencies having jurisdiction over Montana-Dakota Utilities Co. (Montana-Dakota) system, require us to provide safe and reliable service. The Federal Energy Regulatory Commission (FERC), having authority over the entire interconnected electric grid and all wholesale transactions, has established the NERC operating guidelines as the guiding standards and practices for all jurisdictional utilities. Montana-Dakota complies with the existing manuals, standards, and guidelines of the NERC, Midwest ISO, Applicable Reliability Council, or any successor agency assuming or charged with similar responsibilities related to the operation and reliability of the North American electric interconnected transmission grid.

The requirements set forth by this document are intended to comply with the FERC's final rules on Open Access (FERC Orders 888, 889), all state and federal regulatory agency requirements and other applicable requirements of other entities related to owners and operators of electric Systems and associated interconnected facilities such as NERC, Midwest ISO, Applicable Reliability Council, or any successor agency assuming or charged with similar responsibilities related to the operation and reliability of the North American electric interconnected transmission grid. These requirements are based on today's NERC enforceable standards.

B. Objectives

The purpose of this document is to provide a template for developing the technical guidelines to interconnect with the Montana-Dakota electric system in establishing the interconnection in an efficient and consistent manner to meet the minimum requirements for safe and reliable operation of the parallel interconnection. This document is designed to develop the necessary requirements to comply with the North American Electric Reliability Corporation's (NERC) Standard FAC-001.

This template is not intended to be a design specification or instruction manual but to provide the technical guidance needed to achieve the following:

- Ensure the safety of the general public and Montana-Dakota personnel.
- Maintain the reliability and service of all users of the Montana-Dakota System.
- Minimize the possible damage to the property of the general public, Montana-Dakota Customers, and Montana-Dakota.
- Minimize adverse operating conditions on the Montana-Dakota System.
- Permit the interconnection customer to operate in parallel with the Montana-Dakota System in a safe, reliable and efficient manner.
- Accurately measure and account for all injections and extractions from the interconnected system.

C. Interconnection Procedures

The interconnection procedures for establishing interconnection to the Montana-Dakota Transmission System are pursuant to Attachment X under the Midwest ISO Open Access Transmission. Additional information on the MISO interconnection procedures may be found at the following website:
http://www.midwestmarket.org/publish/Document/25f0a7_11c1022c619_-7d600a48324a
Additional information on Montana Dakota's interconnection procedures may be found on the Company's website at http://www.montana-dakota.com/Pages/Overview.aspx

II. General Policy and Requirements

A. Compliance with Interconnection Requirements

It is the responsibility of the interconnection customer to obtain all permits and approvals of the governing bodies and to comply with all applicable electrical and safety codes. Generator interconnections that fall under the state jurisdictions are covered under this document and must meet utility and state specific processes and criteria.

The interconnection customer is responsible for ensuring that the interconnection complies with all NERC, Midwest ISO, Applicable Reliability Council, and state planning, design, operating standards – including periodic unit testing, Midwest ISO procedures, and the appropriate state procedures.

B. Responsibility and Approval

Approval of the proposed interconnection only ensures that Montana-Dakota has reviewed the interconnection to make certain that the Montana-Dakota System can be maintained and that other Montana-Dakota customers are not adversely affected by operation of the interconnecting Facilities.

C. Interconnection Customer Financial Obligation

Through appropriate agreement(s), Montana-Dakota may make provisions to recover costs. The following expense categories are examples of (but not all-inclusive of) items reimbursable to Montana-Dakota:

- Meter installation, tests, maintenance, parts and related labor
- Meter reading and scheduling
- Telemetry installation, tests, maintenance, parts and related labor
- Operating expenses, including communication circuits
- Study analysis and related expenses
- Securing NERC Regional Entity or equivalent acceptance
- Modifications to the Montana-Dakota System and related labor/engineering
- Protective device installation/equipment cost and related labor
- Protective device settings review and coordination
- Review of design, inspection and testing costs Programming costs to incorporate generation and tie-line data into Montana-Dakota's SCADA
- Land, rights-of-way, licensing, permitting, engineering, etc.
- Control Area Services costs

D. NERC Compliance

If operation of the interconnection customer's Facility causes Montana-Dakota to be out of compliance with any applicable rules, regulations, and/or requirements of NERC, Midwest ISO, Applicable Reliability Council, or any successor agency assuming or charged with similar responsibilities related to the operation and reliability of the Bulk Electric System, and if Montana-

Dakota is assessed a penalty, fee, or charge for such non-compliance, said penalty will be passed through to the interconnection customer.

E. Montana-Dakota as a Balancing Authority Area Operator

Montana-Dakota is the Local Balancing Area Operator for a large geographic area comprising parts of the states of Montana, North, and South Dakota. Interconnected Customer will be part of the Montana-Dakota Local Balancing Authority Area unless alternative arrangements are made and approved by Montana-Dakota for connecting to a different Balancing Authority.

Montana-Dakota Local Balancing Authority is a member of the Midwest ISO and participates in the Midwest Energy and Ancillary Services market. Montana-Dakota Local Balancing Authority has entered into a Balancing Authority and a NERC Joint Registration Organization with the Midwest ISO Balancing Authority. Any operations of interconnected equipment or facilities will fall under the direction of the Balancing Authority Area Operator. All facilities or entities scheduling within, in, or out of the Montana-Dakota Local Balancing Authority Area may need to become marketing participant within the Midwest Energy and Ancillary Services Market.

F. Requests for Transmission Service

The ability to interconnect to the Montana-Dakota System does not mean the interconnection customer can deliver or receive power over Montana-Dakota's facilities at all times and to any location. This determination is made under the Transmission Provider's Tariff and through reservation of transmission service.

If the interconnection customer intends to wheel power over Montana-Dakota's transmission facilities, the interconnection customer must contact the Midwest ISO concerning obtaining transmission service.

III. General Information

A. Interconnection Ties

Identified within this section are general requirements that apply to interconnecting generating, end-user and transmission equipment with the Montana-Dakota System including three-phase generators or inverter installations. Some requirements are dependent upon the size of the installation as will be noted in the requirements. Additionally, the requirements to interconnect generation may vary depending upon:

- Whether the interconnection transfer is open or closed.
- Interconnection voltage.
- Interconnection power flow (one-way or two-way).
- Interconnect size, type, or location.
- The scheduling of energy within Montana-Dakota's Local Balancing Area.
- State interconnection requirements

B. Generator Interconnections

1. Classifications

For the purpose of this document, interconnection customer-owned generators are classified as either "Selfservice" or "Wholesale" generators.

a) Self-Service Generators

Self-service generators (Open Transfer, Quick Open, Parallel, or Soft Loading) are those whose purpose is to serve only on-site customer loads and not to deliver power over Montana-Dakota's or other utilities electric facilities. At a minimum, these installations must demonstrate to Montana-Dakota's satisfaction their compliance with the Montana-Dakota design standards.

b) Wholesale Generators

Wholesale generators (Soft Loading Extended) are those units where the interconnection customer plans to sell power and/or energy to others or deliver such power over Montana-Dakota's or another utility's facilities (wheeling). In order for the generator to sell capacity, the generator must be reviewed and approved by Midwest ISO and/or the Applicable Reliability Council. Wholesale Generator installations may also be required to receive Midwest ISO or Applicable Reliability Council accreditation.

2. Generator Testing and Performance Requirements

The interconnection customer must agree to perform any and all testing of each generator as required by the Applicable Reliability Council and/or the Midwest ISO. The specific testing requirements depend on the type of prime mover for the Facility.

3. Modeling Requirements for Generation Greater than 5MW

All generator/exciter/governor manufacturer data sheets must be available for modeling in transient/voltage stability, short circuit, and relay setting calculation programs. This includes generator reactive capability curves and exciter saturation curves. The interconnection customer will supply accurate data necessary for transient stability, voltage stability and steady state modeling of the facilities. At a minimum, generator nameplate data must be specified, including the rated voltage, the MW and MVAR capacity or demand, impedance and the power factor capability of the generator. The actual test data must be provided.

4. Generator Step-up (GSU) and Auxiliary Transformers

For compliance to VAR-002, interconnection customer must PROVIDE TO Montana-Dakota, tap settings, available fixed tap ranges, impedance data, the +/- voltage range with step-change in % for load-tap changing transformers for each interconnecting GSU and Auxiliary Transformer.

The available voltage taps of the interconnection customer's step-up transformer will be reviewed by Montana-Dakota for its suitability with the Montana-Dakota System. The interconnection customer is expected to request this review before acquiring the transformer. Montana-Dakota shall determine which voltage taps would be suitable for a step-up transformer for the Interconnection customer's proposed project. Suitable taps are required to give the transformer the essential capacity for the generator to:

- Deliver maximum reactive power to Montana-Dakota's System at the Point of Interconnection (generator operating to at least 95 percent lagging power factor).
- Absorb maximum reactive power from Montana-Dakota's System (generator operating to at least 95 percent leading power factor).
- Help maintain a specified voltage profile on Montana-Dakota's system for varying

operating conditions.

5. Automatic Generator Control -50MW and Larger

The interconnection customer's generator shall be equipped with Automatic Generator Control ("AGC") equipment to permit remote control of the unit and enable the generation to be increased or decreased via Automatic Generation Control. This requirement does not apply if the plant is exempt under NERC, Midwest ISO, or Applicable Reliability Council rules due to prime mover or regulatory limitations. Any remote control that is required will be implemented through the telemetry equipment identified in Section VIII.

6. Synchronization of Interconnection Customer's Generation

All interconnection customers, independent of generator size classification, are responsible for synchronization of interconnection customer's generation to the Montana-Dakota System. Before synchronization to the Montana-Dakota System will be permitted, all required studies, tests and inspections, and contracts must be completed and approved.

C. End-User Interconnection

Interconnection customer's that represents end-user load connecting to the Montana-Dakota system must adhere to the applicable sections of this document. Any remote control that is required will be implemented through the telemetry equipment identified in Section VIII.

D. Transmission Interconnections

Interconnection customers that represent a transmission connection from another transmission owner to the Montana-Dakota system must adhere to the applicable sections of this document. Any remote control or indication that is required will be implemented through the telemetry equipment identified in Section VIII.

IV. Regional Entities Coordination

A. Coordination of Studies (R2.1.1)

An Interconnection customer will be required to submit an interconnection application for any new or modified Facility seeking to interconnect to the Montana-Dakota System. Depending on the size, type, and location of a new or modified Facility, a study could be performed by either: (1) Montana-Dakota; or (2) the Midwest ISO; or (3) the Applicable Reliability Council; or (4) a neighboring transmission owner; or (5) a neighboring load serving entity. Montana-Dakota will have a different role to ensure coordination of studies for either new or modified facilities depending on who performs the study.

In the event that a study for a new or modified facility is performed by Montana-Dakota, the following steps shall be taken:

1. Montana-Dakota will develop a study scope for the evaluation of a new or modified facility and request participation of interested parties in an ad hoc study group (including neighboring transmission owners, the Midwest ISO, the Applicable Reliability Council,

and neighboring transmission owners.

2. Montana-Dakota will ensure the study scope include NERC Reliability Standards and applicable Regional, Power Pool, and Montana-Dakota system planning criteria and facility connection requirements[1] and in addition includes the necessary steady-state, short-circuit, and dynamics studies to evaluate system performance in accordance with Reliability Standard TPL_001-0[2]

3. Montana-Dakota will perform a study of the new or modified facility to evaluate of the reliability impact of the new facilities and their connections on the interconnected transmission system in accordance with the guidelines and directives of the study scope based on input from the ad hoc study group[3].
4. Montana-Dakota will share study results and seek input from the ad hoc study group when reviewing study results to formulate coordinated conclusions and recommendations from the study work.
5. Montana-Dakota will develop a study report documenting study criteria, procedures, assumptions, system performance (results), conclusions and jointly developed recommendations for review by the ad hoc study group[4].
6. Montana-Dakota will solicit input on the study report by the ad hoc study group and make the necessary revisions based on input from the ad hoc study group.
7. Once consensus is reached among the members of the ad hoc study group, Montana-Dakota will share the study report with the Interconnection customer and affected parties that did not participate in the ad hoc study group[5].

Montana-Dakota shall retain its documentation (of its evaluation of the reliability impact of the new facilities and their connections on the interconnected transmission systems) for three years.

When a study for a new or modified facility is performed by a party other than Montana-Dakota, the following steps shall be taken:

1. Montana-Dakota will seek involvement to participate in an ad hoc study group for new facilities proposing to interconnect to the Montana-Dakota System or for existing facilities proposing to be modified.
2. Montana-Dakota will strive to ensure that the study assumptions and procedures are inclusive proposed by the party performing the study are detailed enough to determine if new facilities will meet facility connection requirements of Montana-Dakota.
3. Montana-Dakota will ensure that criteria are met to maintain acceptable system reliability on the System based on the requirements of Montana-Dakota.
4. Montana-Dakota will actively participate in ad hoc study groups and provide comments on study results (when necessary) and assist in formulating conclusions and recommendations of studies.
5. Montana-Dakota will review study reports and provide comments, as necessary, to

[1] FAC-002 R1.2
[2] FAC-002 R1.4
[3] FAC-002 R1.1
[4] FAC-002 R1.5
[5] FAC-002 R1.3

ensure that a new facility (or modification of an existing facility) is not degrading the reliability of the System.

B. Notification of Modifications (R2.1.2)

Upon notification of a new or modified Facility connected to the Montana-Dakota System, Montana-Dakota shall take the following steps to ensure that others are informed of the change to the System:

1. Schedule an internal meeting within Montana-Dakota to gather personnel from all impacted areas (Planning, Operations, Engineering, Relaying, Substations, Communications, etc...)
2. Integrate the system change into the applicable models (MISO real-time network and commercial models, MISO planning model, MRO planning model, Montana-Dakota state estimator (PSS/ODMS) model, etc...)
3. Depending on the magnitude of the new or modified facility, inform the Midwest ISO, the Applicable Reliability Council, neighboring transmission owners, neighboring load serving entities, and neighboring distribution providers through the MAPP Sub regional Planning Group (SPG) forums, MISO Sub regional Planning Meetings (SPM) and insert (as appropriate) into the MISO Transmission Expansion Plan (through insertion into MTEP Appendices A, B, or C) and the MAPP Transmission Plan.

V. Voltage Level and MW and MVAR Capacity or Demand at Point of Connection (R2.1.3)

Any Interconnection customer interested in interconnecting to the Montana-Dakota System must complete an interconnection application. Among several other characteristics of the planned interconnection, the interconnection application must specify the Point of Interconnection, the voltage level at which the interconnection is desired, and the MW and MVAR capacity (for generation) or MW and MVAR demand (for end-user facilities) expected for the new (or modified) facility.

A completed interconnection application must be reviewed by Montana-Dakota and will not be deemed complete by Montana-Dakota until all of the appropriate information is included on the application. Montana-Dakota will then establish communication with the Interconnection customer upon submittal of a completed interconnection application to begin the interconnection process.

VI. Breaker Duty and Surge Protection (R2.1.4)

At a minimum, the Interconnection Customers must follow ANSI / IEEE Std C37.90.1-1989 (R1994), IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems

Also, please refer to section VII.A.4 for fault criteria and section X.A and X.B for surge requirements.

VII. Protection Requirement

At a minimum, the Interconnection Customers must follow the applicable ANSI/IEEE Guide:
ANSI/IEEE C37.91, Guide for Protective Relay Applications to Power Transformers
ANSI/IEEE C37.95, Guide for Protective Relaying of Utility-Customer Interconnections
ANSI/IEEE C37.97, Guide for Protective Relay Applications to Power System Busses
ANSI/IEEE C37.101, Guide for Generator Ground Protection
ANSI/IEEE C37.102, Guide for AC Generator Protection
ANSI/IEEE C37.106, Guide for Abnormal Frequency Protection for Power Plants
ANSI/IEEE Std 1001, Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Utility Systems
ANSI / IEEE Std C37.90.1-1989 (R1994), IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems

A. For all Interconnections

An important objective in the interconnection of facilities to the Montana-Dakota System is minimizing the potential hazard to life and property. A primary safety requirement is the ability to disconnect immediately when a fault on the System is detected. The protection equipment for an interconnected facility must protect against faults within that facility and faults on the Montana-Dakota System. No new facility on the Montana-Dakota System should degrade the existing Montana-Dakota protection and control schemes or lower the levels of safety and reliability to other customers.

Montana-Dakota's minimum protection requirements are designed and intended to protect Montana-Dakota's system only. Neither party should depend on the other for the protection of its own equipment. Montana-Dakota shall assume no liability for damage to interconnection customer-owned Facilities resulting from miscoordination between the interconnection customer's protective device(s) and Montana-Dakota's protective devices. It is the interconnection customer's responsibility to protect its own system and equipment.

Several factors may determine what protective devices are required on the interconnection customer's interconnection. The following three major factors generally determine the type of protective devices required at the Point of Interconnection:

- Type and size of the interconnection customer's interconnecting equipment.
- Location of the interconnection customer on the Montana-Dakota System.
- Manner in which the installation will operate (one-way vs. two-way energy flow).

The addition of the interconnection customer's Facility may also require modifying the Montana-Dakota System. These determinants will be made by Montana-Dakota during an evaluation of a new interconnection. Each interconnection request will be handled individually and Montana-Dakota will solely determine the protective devices, System modifications, and/or additions required. Montana-Dakota will work with the interconnection customer to achieve an installation that meets the requirements of both the interconnection customer and Montana-Dakota. The interconnection customer shall bear all costs allowed for protective devices and Montana-Dakota System modifications required to permit the operation of the parallel interconnection.

Montana-Dakota shall operate all Montana-Dakota -owned protective equipment at the interconnection to ensure that the protection and control requirements and objectives are met. During the interconnection process, Montana-Dakota will approve the proposed type of interconnection protective devices, ownership, operating details and equipment settings. Montana-Dakota is not liable or responsible for protection of the interconnection customer's

facilities.

1. Disconnect

The disconnecting equipment shall be National Electrical Manufacturers Association (NEMA) approved for the specific application and location.

A manual disconnect device should be installed to isolate the Montana-Dakota System from the interconnection customer's Facility. This disconnect shall open all the poles except the neutral and shall provide a visible air gap to establish required clearances for maintenance and repair work of the Montana-Dakota system. A breaker that can be racked out into a visibly open position is also acceptable.

Please refer to section IX for Switching, Grounding and Safety Issues.

2. Protective Relay Requirements

Protective relays are required to promptly sense abnormal operating or fault conditions and initiate the isolation of the faulted area. All Generation, Tie-line and Substation Interconnections shall use utility grade relays. Protective relay settings on interconnect breakpoints must be approved by Montana-Dakota.

Montana-Dakota requires line-protective equipment to either 1) automatically clear a fault and restore power, or 2) rapidly isolate only the faulted section so that the minimum number of customers is affected by any outage. Fault-interrupting equipment should usually be located at the Point of Interconnection or as close to the Point of Interconnection as practicable. High-speed fault clearing may be required to minimize equipment damage and potential impact to system stability.

The need for high speed fault clearing shall be determined on a case-by-case basis by Montana-Dakota. Additional protective relays needed to adequately protect the Generation Facility must, at a minimum, meet IEEE Standards C37.90, C37.90.1, and C37.90.2. Interconnection customers shall submit complete control and relaying documentation that pertains to protection of the Montana-Dakota System.

Tables 1 and 2, later in this section, provide protective device recommendations necessary to protect Montana-Dakota equipment and its customers equipment against electrical faults (short circuits), degraded voltage or frequency operation, unwanted power flow and inadvertent out of phase closing of breaker/switches. Some protective devices may or may not be required for interconnection customers as determined by Montana-Dakota on a case-by-case basis. Generator protection may depend upon the size of the generator, location and nature of interconnection and coordination requirements with Montana-Dakota protective systems or state interconnection requirements. All necessary protective requirements will be identified an evaluation of any new interconnection request.

3. Reliability and Redundancy

The failure to trip during a fault or abnormal system conditions due to relay or breaker hardware problems, or from incorrect relay settings, improper control wiring, etc. is always a possibility. The protection system must be designed with enough redundancy that failure of any one component still allows the Facility to be isolated from the Montana-Dakota System under a fault condition. If the Facility's breaker does not trip,

the incoming breaker should trip after a predetermined time delay. Similarly, if the incoming breaker fails to trip, the Facility's breaker should trip. Where there is no incoming breaker, the Montana-Dakota tie breaker may be tripped.

4. Generation Protection

Generation relays must coordinate with the protective relays at the Montana-Dakota breakers for the substation on which the interconnection customer's Facility is connected.

Table 1. Basic Generation Protection Devices (Protection Needs to be redundant for all interconnections at 69 kV and above.

Generator Protection Device	Device Number	1 Mw or Less	1 MW and Larger
Phase Overcurrent	50/51	X	X
Differential	87		X
Overvoltage	59	X	X
Undervoltage	27	X	X
Overfrequency	81O	X	X
Underfrequency	81U	X	X
Ground Over Voltage (ground fault protection for ungrounded system at the interconnection customer's end)	59G	TBD	TBD
Synchronizing and Reclosing Relays	25	TBD	TBD
Ground Fault Sensing Scheme	51N	X	X
Overcurrent With Voltage Restraint/Voltage Control or Impedance Relay	51V 21	X	X
Reverse Power Relay	32	X	X
Out of Step	68	TBD	TBD

TBD = to be determined on a project-by-project basis

5. Transmission Protection

Transmission Line protection relays must coordinate with the protective relays at the Montana-Dakota breakers for the line on which the interconnection customer's Facility is connected. The typical protective zone is a two-terminal line section with a breaker on each end. In the simplest case of a load on a radial line, current can flow in one direction only, so protective relays need to be coordinated in one direction and do not need directional elements.

In coordinating a multi-terminal scheme, Montana-Dakota may sometimes require

installation of a transmission line protective relay at the interconnection customer's substation site. Because this line relay participates in a scheme to protect the Montana-Dakota System, Montana-Dakota must ensure the maintenance, testing and reliability of this particular type of relay.

The breaker's relays must be set to have overlapping zones of protection in case a breaker within any given zone fails to clear. The line protection schemes must be able to distinguish between generation, inrush, load and fault currents. Existing relay schemes may have to be reset, replaced, or augmented with additional relays at the interconnection customer's expense, to coordinate with the interconnection customer's Facility.

The Montana-Dakota System required relays must be located so that a fault on any phase of the Montana-Dakota line shall be detected. If transfer trip protection is required by Montana-Dakota, the interconnection customer shall provide at its expense a communications circuit. This circuit may be fiber optic cable, a communication line from the telephone company, or a dedicated cable. In certain cases power line carrier or microwave communication circuits are also acceptable. The line must have high-voltage protection equipment on the entrance cable so the transfer trip equipment will operate properly during fault conditions.

Tables 2 list the minimum protection that Montana-Dakota requires for any new transmission interconnection. Higher voltage interconnections require additional protection due to the greater potential for adverse impact to system stability and the greater number of customers who could be affected. The acceptability and additional requirements of these interconnection requests shall be determined by Montana-Dakota on a case-by-case basis.

6. End-Use Protection

End-User relays must coordinate with the protective relays at the Montana-Dakota breakers for the substation on which the interconnection customer's facility is connected. Faults within the interconnection customer's system (beyond interconnecting transformer) shall require fault interruption by the Montana-Dakota protective equipment. If the interconnection customer's system has synchronously connected generation or is normally looped to other fault sources, the protection systems at the point of interconnection customer's interconnection may be classified as transmission Protection Systems under NERC PRC-005. If this classification occurs, then these systems will be subject to compliance with the NERC PRC standards and subject to transmission protection provisions of this document.

7. Fault Current

The combined available fault current of the Montana-Dakota System and the interconnection customer's facilities must not overstress Montana-Dakota equipment. The interconnection customer shall provide any necessary provisions to satisfy this requirement. The designed maximum available fault current on the Montana-Dakota System is site specific.

Protective equipment on the Montana-Dakota System is specified within these limits. If the installation of interconnection customer-owned equipment causes these fault current limits to be exceeded, the interconnection customer must install equipment to limit the

fault current on the Montana-Dakota delivery system or compensate Montana-Dakota for the additional costs of installing equipment that will safely operate within the available fault current. The exact value of available fault current depends upon location and circuit configuration and will be determined during the interconnection process. The interconnection customer must work closely with Montana-Dakota during the interconnection.

8. Fault-Interrupting Devices

The fault-interrupting device selected by the interconnection customer must be reviewed and approved by Montana-Dakota for each particular interconnection. Montana-Dakota will determine the type of fault-interrupting device required for a Facility based on the available fault duty, the local circuit configuration, the size and type of generation, and the existing Montana-Dakota protection equipment.

There are two basic types of fault-interrupting devices:

a) Circuit Breakers

Ownership of the intertie circuit breaker will be determined during the interconnection process. However, Montana-Dakota will have the operational authority to operate all intertie circuit breakers at all installations where the interconnection customer's generation has been classified as greater than 5 MW and for all substation or tie-line interconnections. Upgrading existing circuit breakers within or outside the area of the interconnection may be required at the interconnection customer's expense due to the increased fault current levels.

A three-phase circuit breaker at the Point of Interconnection automatically separates the interconnection customer's Facility from the Montana-Dakota System upon detection of a circuit fault. Additional breakers and protective relays may be installed in the interconnection customer's Facility for ease in operating and protecting the Facility. The interconnection breaker must have sufficient capacity to interrupt maximum available fault current at its location and be equipped with accessories to:

- Trip the breaker with an external trip signal supplied through a battery (shunt trip).
- Telemeter the breaker status when it is required.
- Lockout if operated by protective relays required for interconnection.

b) Circuit Switchers

A circuit switcher is a three-phase fault-interrupter with limited fault interrupting capability. These devices have typically been used at voltages of 115 kV and below and may substitute for circuit breakers when the fault duty is within the interrupting rating of the circuit switcher. With Montana-Dakota approval, some circuit switchers with blades can double as the visual open disconnect switch between the metering transformers and the main transformer.

9. Automatic Reclosing/Voltage Check Schemes

Montana-Dakota normally applies automatic reclosing to all transmission and overhead distribution lines. Prior to automatic reclosing, the interconnection customer must ensure that the interconnection customer's Facility is disconnected from the Montana-Dakota System. It may be necessary to install synchronism check schemes at various

locations on the Montana-Dakota System to prevent automatic reclosing in the event that an interconnection customer's Facility remains connected to an isolated, unfaulted section of the Montana-Dakota System. These synchronism check schemes may be located at the Point of Interconnection, at automatic circuit reclosers on the line feeding the interconnection customer, or on a Montana-Dakota source substation feeder breaker. Any modifications to Montana-Dakota reclosing practices and/or addition of synchronism check schemes will be determined during the evaluation of any new interconnection.

In general, reclosing practices should be as follows:

- There should be no automatic reclosing for the incoming breaker.
- The Montana-Dakota substation breaker may have one or more timed recloses, with the first set at a minimum of 2 seconds. It is expected that either the generator or the tie breaker will open before reclosing takes place.
- Where islanding is possible, the Montana-Dakota substation breaker may need the function of voltage supervision from the tie-line.

B. Additional Protection for Generation Interconnections

The generating unit must meet all applicable American National Standards Institute (ANSI) and Institute of Electrical and Electronic Engineers (IEEE) standards. The prime mover and the generator should be able to operate within the full range of voltage and frequency excursions that may exist on the Montana-Dakota system without damage to the unit.

1. Special Protection Scheme

The Montana-Dakota System has been developed with careful consideration for system stability and reliability during disturbances. The type of connection, size of the load, breaker configurations, load characteristics, and the ability to set protective relays will affect where and how Facility's operated. However, the application must meet the applicable reliability council and Montana-Dakota guidelines.

2. Event Recorder

All generation facilities with a rating greater than 5MW or equipped with a Power System Stabilizer must have relaying capable of event recording that will enable Montana-Dakota to make an after-the-fact determination of the status of the generation facility at the time of a system disturbance, should such determination be required. The generation facility operator shall ensure that such time reading is correct and synchronized to an accurate time standard. The event recorder or other recording device(s) at the generation facility must be capable of providing a record of (1) the time of any relay operations and targets of the relay that caused the generation facility to separate, if applicable, (2) the time of any paralleling with and separations from the Montana-Dakota System and (3) the time of the change in voltage-control device set points (if applicable) and (4) the time of change in the operating status (i.e. opened or closed) of any other voltage-control device (i.e., shunt capacitors or reactors) and (5) record of deliveries to the Montana-Dakota System of real power in kW and reactive power in kVAr and output voltage in kV.

VIII. Metering and Telecommunications (R2.1.6)

A. Common

1. Metering

The metering scheme shall be designed such that energy (kWh) delivered to the transmission system is net generation and energy (kWh) delivered to the customer is load. Thus for a generator interconnect, station service is load, when generator output is less than station service.

Modifications to the revenue metering are usually required for any new interconnection. The metering equipment will need to measure both delivered and received energy (both Watts & VArs). This is typically accomplished by replacing an existing watt-hour meter with a multi-function bidirectional meter. This allows proper measurement of both real and reactive energy in both directions. The metering installation shall be electrically connected on the line side the generator step-up transformer, thus including the transformer losses.

For substation metering, the meter is typically located on the high side of the step-down transformer, thus including the transformer losses.

2. Metering Accuracy, Testing and Repair

a) Metering Accuracy

The metering shall adhere to the accuracy standard specified in ANSI standard C-12.1 applicable at the time the metering is installed. Any current or potential transformers that are used for metering will adhere to the "Accuracy Classifications for Metering" listed in ANSI standard C-57.13.

b) Periodic Testing

The metering equipment shall be tested periodically, and re-calibrated to maintain the required accuracy. The meter testing frequency shall at a minimum be based on industry accepted practices and guidelines outlined in ANSI standard C-12.1. Montana-Dakota's present testing practices are based on the type of metering situation and the jointly agreed to requirements of both parties involved. Typically, the metering equipment at non- Montana-Dakota sites is tested every three years.

The periodic test frequency for the metering equipment will be decided upon during the evaluation of a new interconnection. The owner of the meter shall analyze and distribute any maintenance, repair, and test results to all parties receiving the meter readings.

c) Meter and Telemetry Equipment Repair

The owner of the metering and telemetry equipment is responsible for ensuring that the equipment is adequately maintained and is repaired within a reasonable time after a failure is detected. The repair or replacement of a bad meter must be completed within 24 hours after it has been detected. If the metering cannot be repaired within that time, Montana-Dakota may request the interconnection customer to open the interconnection until the meter has been

repaired.

All changes, repairs, and replacements of the meter must be coordinated with the Montana-Dakota Meter Department. This assures Montana-Dakota that the meter is functioning properly.

3. Metering and Telemetry Function Requirements

The meter and telemetry requirements define Montana-Dakota's required functionality for meters, metering related equipment (phone lines, phone circuits, current transformers, potential transformers, etc.) and telemetry equipment (Remote Terminal Units (RTUs), transmitters, receivers, etc.). They do not represent design standards for the metering equipment.

Each request for interconnection will be handled individually and Montana-Dakota will solely determine the metering and telemetry modifications and/or additions required. Montana-Dakota will work with the interconnection customer to achieve an installation that meets the requirements of both the interconnection customer and Montana-Dakota. The interconnection customer shall bear the costs of metering and telemetry modifications required to permit the operation of a parallel interconnection.

a) Additional Measured Values For Generating Stations With A Net Output Capacity Greater Than Or Equal to 1 MW

   i. Real Power Flow (Watts)
   ii. Reactive Power Flow (VArs), at Montana-Dakota's discretion
   iii. Voltage at the Point of Interconnection to Montana-Dakota System (Volts), at Montana-Dakota's discretion

b) Additional point for units requiring Telemetry Generating Stations with a net output capacity of 5 MW or greater

   i. Position (open/close) of generator breaker(s) and incoming and tie breakers (if present)
   ii. Remote Terminal Unit or Data Link to telemeter all measured values to Montana-Dakota's SCADA System.

c) Measured Values and Metering Equipment Required For Transmission Interconnections that create a new boundary between Local Balancing Areas

   i. bi-directional Real Power Flow (Watts)
   ii. bi-directional Reactive Power Flow (VArs)
   iii. Voltage at the Point of Interconnection to Montana-Dakota's System (Volts), at Montana-Dakota's discretion
   iv. Interval Recorder to capture hourly energy use
   v. Remote Terminal Unit or Data Link to telemeter all measured values to Montana-Dakota's SCADA System.

d) Measured Values and Metering Equipment Required For Load Interconnections to Transmission System (non-parallel interconnection)

i. Real Power Flow (Watts)
ii. Reactive Power Flow (VArs)
iii. Interval Recorder to capture hourly energy use

B. Telemetry

The requirements for telemetry are based on the need of the System Control Center to protect all users of the System from unacceptable disturbances. The need for requiring telemetry may include the ability to monitor the following conditions:

- Detecting Facility back feed onto otherwise de-energized lines
- Providing information necessary for reliable operation of Montana-Dakota equipment(feeders, substation, etc.) during normal and emergency operation
- Providing information necessary for the reliable dispatch of generation

Telemetry is required by Montana-Dakota when:

- The possibility of islanding a portion of Montana-Dakota's System exists
- 1 MW or larger generator
- The Facility plans to provide its own ancillary services.
- There is intent to sell power and energy over Montana-Dakota Facilities.
- The Facility is required to meet the manual load shed requirement.
- 69 kV substations are equipped with circuit breakers and for all substations classified at 115 kV and above.
- FERC requires telemetering for normally open or emergency tie connections.

If "islanding" is a possibility, it will be identified during the evaluation of the new interconnection. In such instances, the following telemetry may be required:

- Real and reactive power flow for each generator (kW and kVAr)
- Voltage representative of the Montana-Dakota service to the Facility
- Status (open/close) of Facility and interconnection breaker(s)
- Position of incoming and tie breakers or switches
- Energy output of the generators (kWh)
- Interconnection customer load from Montana-Dakota service (kW and kVAr)

When telemetry is required, the interconnection customer must provide the communications medium to Otter Tail. If a telephone circuit is used, the interconnection customer must also provide the telephone circuit protection and coordinate the RTU addition with Montana-Dakota.

C. Communication Channel

Montana-Dakota may require that a communication channel and associated communication equipment be installed as part of the protective scheme. This channel may consist of power line carrier, leased telephone line, pilot wire circuit, fiber optic cable, radio, or other means. The communication channel is required in cases where it is necessary to remotely send a signal to remove the interconnection customer's Facility from the Montana-Dakota System due to a fault or other abnormal conditions that cannot be sensed by the protective devices at the interconnection customer's location. Some instances may require installation of communication equipment in Montana-Dakota substations to initiate the protective signals. Montana-Dakota shall be reimbursed by the interconnection customer for the cost of this equipment and its installation.

Another communication channel may be needed for monitoring and control purposes. Telemetry requirements were previously addressed in this section. Specific communication channel requirements will be determined during the interconnection study process. The cost of installation

and additional monthly fees for this channel will be the responsibility of the interconnection customer.

D. Supervisory Control and Data Acquisition (SCADA) Requirements

SCADA indication of real and reactive power flows and voltage levels is required. If the connection is made directly to another utility's transmission system, SCADA control and status indication requirements shall be jointly determined. SCADA control and status indication of the power circuit breakers and associated isolating switches used to connect with Montana-Dakota may be required. SCADA control of breakers and isolating switches that are located at other than the Point of Interconnection is not normally required, although status indication may be necessary.

All substations with a circuit breaker rated at 69 kV or greater and all generation 5 MW or greater shall provide SCADA for the circuit breaker to the Balancing Authority Area. The following equipment data and status must be provided in a 6 second or less periodicity to the Balancing Authority Area:
Breaker position Motor operated disconnect position Transmission line flow and alarming Bus voltage and alarming battery and associated equipment status Protective relaying AC and DC voltage status Protective relay communication channel status Transformer and associated equipment status Lockout relay status Capacitor/reactor status Other points as necessary to provide control and indication

IX. Switching, Grounding and Safety Issues (R2.1.7)

A. Safety and Isolating Devices

At the Point of Interconnection to the Montana-Dakota System, an isolating device, which is typically a disconnect switch, shall be provided that physically and visibly isolates the Montana-Dakota System from the interconnection customer's Facilities. All switchgear that could energize equipment shall be visibly identified (tagged), so that all maintenance crews can be made aware of the potential hazards. Such devices shall:

- Simultaneously open all phases (gang-operated) to the connected Facilities.
- Be accessible by Montana-Dakota and may be under Montana-Dakota System Operator jurisdiction.
- Be lockable in the open position by Montana-Dakota.
- Not be operated without advance notice to either party, unless an emergency condition requires that the device be opened to isolate the Interconnected Facilities.
- Be suitable for safe operation under the conditions of use.

Montana-Dakota may require the design to allow the application of safety grounds on the Montana-Dakota side of the disconnect (or breaker). OSHA lockout/tag requirements must be followed.

The disconnect (or breaker) must be accessible at all times to Montana-Dakota personnel. Disconnects should allow for padlocking in the open position with standard Montana-Dakota padlock. The interconnection customer shall not remove any padlocks or Montana-Dakota safety tags. The disconnect (or breaker) should be located outside of the building if possible. If not possible, interconnection customer must provide access to disconnect (or breaker) at all times

(24 hour day phone number, guard desk, etc.) The disconnecting equipment must be clearly labeled.

Montana-Dakota personnel may lock the device in the open position and install safety grounds if:

- It is necessary for the protection of maintenance personnel when working on de-energized circuits.
- The interconnected Facility or Montana-Dakota equipment presents a hazardous condition.
- The interconnected Facility interferes with the operation of the Montana-Dakota System.
- The Montana-Dakota System interferes with the operation of the interconnected Facility.

B. Energization of Montana-Dakota Equipment by the Interconnection Customer

No interconnection customers, independent of interconnection type or generator size, shall energize a de-energized Montana-Dakota circuit. The necessary control devices shall be installed by the interconnection customer on the interconnection customer's Interconnection Facilities to prevent the energization of a de-energized Montana-Dakota circuit. Connection may be accomplished only via synchronization with the Montana-Dakota System. All interconnecting circuit breakers/devices and all breakers/devices that tie another source to the Montana-Dakota System will require synch-check relaying, other than quick open transition (break before make) transfer switch installations.

C. Substation Grounding

The interconnection customer shall submit the grounding system study and design for Montana-Dakota review and approval. At a minimum, the Interconnection Customers must follow IEEE 80 and IEEE 142 Standards

Each generation site and/or Interconnection substation must have a ground grid that solidly grounds all metallic structures and other non-energized metallic equipment. This grid shall limit the ground potential gradients to such voltage and current levels that will not endanger the safety of people or damage equipment which are in, or immediately adjacent to, the station under normal and fault conditions. The size, type and ground grid requirements are in part based on local soil conditions and available electrical fault current magnitudes. In areas where ground grid voltage rises are not within acceptable and safe limits (due for example to high soil resistivity or limited substation space), grounding rods and wells can be used to reduce the ground grid resistance to acceptable levels.

If the generation site is close to another substation, the two ground grids may be isolated or connected. If the ground grids are to be isolated, there may be no metallic ground connections between the two substation ground grids. Cable shields, cable sheaths, station service ground sheaths, and overhead transmission shield wires can all inadvertently connect ground grids. Fiber-optic cables are an excellent choice for telecommunications and control between two substations to maintain isolated ground grids. If the ground grids are to be interconnected, the interconnecting cables must

have sufficient capacity to handle fault currents and control ground grid voltage rises. Montana-Dakota must approve any connection to a Montana-Dakota substation ground grid.

The interconnection of lines and/or generation may substantially increase fault current levels at nearby substations. Modifications to the ground grids of existing substations may be necessary to keep grid voltage rises within safe levels. The interconnection study will determine if modifications are required and the estimated cost.

X. Insulation and Insulation Coordination (R2.1.8)

Power system equipment is designed to withstand voltage stresses associated with expected operation. Adding or connecting new Facilities can change equipment duty, and may require that equipment be replaced or switchgear, telecommunications, shielding, grounding and/or surge protection added to control voltage stress to acceptable levels. Interconnection studies may identify additional requirements to maintain an acceptable level of Montana-Dakota System availability, reliability, equipment insulation margins, and safety. At a minimum, the Interconnection Customer must follow Standards IEEE C62.41 and IEEE C37.90.1 V&I Basic Insulation Level (BIL) ratings for electric system additions and electric system interface equipment.

Voltage stresses, such as lightning or switching surges, and temporary overvoltages may affect equipment function. Remedies depend on the equipment capability and the type and magnitude of the stress. In general, stations with equipment operated at 15 kV and above, as well as all transformers and reactors, shall be protected against lightning and switching surges. Typically, this includes station shielding against direct lightning strokes, surge arresters on all wound devices, and shielding with rod gaps (or arresters) on the incoming lines. The following requirements may be necessary to meet the intent of Montana-Dakota's reliability criteria.

XI. Surge Protection

The Interconnection shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE/ANSI C62.41 and IEEE C37.90.1.

Montana-Dakota highly recommends the interconnection customer to install surge arresters for protection of transformers and other vulnerable equipment. Arresters shall be mounted in such a manner as to protect any of Montana-Dakota's facilities from surge voltages. In general, all Montana-Dakota incoming lines shall be protected with surge arresters located on the line side of the disconnect switch. All lines connecting to a Montana-Dakota substation shall include surge arresters for substation entrance protection. Montana-Dakota staff will recommend the appropriate level of entrance protection as well as other specifications for surge arresters during the interconnection process.

A. Lightning Surges

If the Requester proposes to tap a shielded transmission line, the tap line to the substation must also be shielded. For an unshielded transmission line, the tap line does not typically require shielding beyond that needed for substation entrance. However, special circumstances such as the length of the tap line may affect shielding requirements.

Lines at voltages of 69 kV and higher that terminate at Montana-Dakota substations must meet additional shielding and/or surge protection requirements. Incoming lines must be shielded for ½ mile at 41.6-69kV and for its entire length at 115kV and higher. For certain customer service substations at 69kV and below, Montana-Dakota may require only an arrester at the station entrance in lieu of line shielding, or a reduced shielded zone adjacent to the station. These variations depend on the tap line length, the presence of a power circuit breaker on the transmission side of the transformer, and the size of the transformer.

B. Temporary Overvoltages

Temporary overvoltages can last from seconds to minutes, and are not characterized as surges. These overvoltages are present during islanding, faults, loss of load, or long-line situations. All new and existing equipment must be capable of withstanding these duties. Temporary overvoltages on the Montana-Dakota System may fall within the voltage range shown on Table 3.

XII. Voltage, Reactive Power, and Power Factor Control (R2.1.9)

A. Voltage

The interconnection customer's equipment shall not cause excessive voltage excursions. The interconnection customer shall provide an automatic means of disconnecting its equipment from the Montana-Dakota System within three seconds if the steady state voltage cannot be maintained within the required tolerance.

For interconnections to the transmission system (generally at or above 41.6kV), voltage levels ± 10 percent from normal can be expected. If the interconnection customer's equipment cannot operate within the range shown in Table 3, the interconnection customer may need to provide regulation equipment to limit voltage level excursions.

Table 3 – Voltage Limit on the Montana-Dakota System

	Low Voltage Limit	High Voltage Limit
Normal Operating Conditions	0.97 p.u.	1.05 p.u.
Emergency Operating Condition	0.90 p.u.	1.10 p.u.
Transient Condition	0.70 p.u.	1.20 p.u.

Consistent with the system performance criteria and technical study guidelines, the Montana-Dakota System is designed to avoid experiencing transient voltage dips below 0.70 p.u. due to external faults or other disturbance initiators. The interconnection customer should allow sufficient dead band in its voltage regulation equipment control to avoid reacting to transient voltage dips.

If the design of the interconnection customer's Facility is such that islanded conditions are possible, appropriate zero sequence sources must also be provided. The usual

customer voltage concern refers to line-line values, but generation installed on distribution lines must also control the line-ground voltage during an islanded condition.

B. Minimum Power Factor Requirements

The interconnection customer will generally be expected to provide for its own reactive power requirements.

1. Substation-Specific Power Factor Requirements

The Montana-Dakota Transmission System is designed and operated assuming the power factor at the transmission side of the distribution transformer is 98 percent lagging when load is within 10 percent of the forecasted system minimum or maximum. Any interconnecting facility is expected to provide sufficient reactive power (leading or lagging) such that during these load periods the high side power factor does not fall below 90 percent.

If during normal operation (system intact or under transmission contingency conditions) the voltage in a portion of the Montana-Dakota System deviates from the voltage range described in Section X.A., Montana-Dakota will survey the interconnected substation(s) believed to be contributing to the voltage concern and the interconnection customer may be asked to demonstrate, (either by metered values or by inventory of installed equipment) that the interconnection customer meets its reactive power obligation. Any deviations are required to be corrected immediately.

2. Generator-Specific Power Factor Requirements

Generators connecting to the Montana-Dakota System will be expected to provide sufficient facilities and controls to operate their generation within a range of ± 95 percent power factor at the Point of Interconnection. The voltage set point that the generator needs to maintain will be established and adjusted as necessary by Montana-Dakota's System Operations Department. (This is necessary for all generation).

a) Reactive Supply and Voltage Control from Generation Sources Services – 10 MW or Larger

Reactive Supply and Voltage Control from Generation Sources Service – 10 MW or Larger

Reactive Supply and Voltage Control from Generation Sources Service is a FERC defined ancillary service. Any generator providing such service to the Balancing Authority Area Operator must be able to automatically control the voltage level by adjusting the machine's power factor within a continuous range of between ± 95 percent power factor based on the station's sum total name plate generating capability. The only exception would be on an interconnection that falls under a state interconnection requirement.

The Voltage Control Response Rate (for synchronous generators, the exciter response ratio) is the speed with which the voltage-controlling device reacts to changes in the system voltage. The minimum response rate for a static excitation system shall have the exciter attain 95 percent of the exciter ceiling

(maximum) voltage in 0.1 seconds. The exciter ceiling voltage shall be at least two times the exciter voltage at the rated full load value. For rotary exciters, the exciter response ratio shall be at least 2.0. The response ratio, ceiling voltage, and speed of response are defined in IEEE 421.2 1990.

Interconnection customers choosing to provide Reactive Supply and Voltage Control from Generation Sources service must coordinate with existing voltage regulation devices. In most cases, this will be a concern for those generators connecting to voltage regulated distribution facilities (12.5 kV and below).

3. Excitation Requirements

Please see Excitation Requirements in Section XVI.

XIII. Power Quality Impacts (R2.1.10)

A. Flicker

Neither Party's facilities shall cause excessive voltage flicker nor introduce excessive distortion to the sinusoidal voltage or current waves as defined by ANSI Standard C84.1-1989, in accordance with IEEE Standard 519, or any applicable superseding electric industry standard. In the event of a conflict between ANSI Standard C84.1-1989, or any applicable superseding electric industry standard, ANSI Standard C84.1-1989, or the applicable superseding electric industry standard, shall control.

Evaluation of a new or modified interconnection may involve a study to determine the reliability impacts on the Montana-Dakota System. This study may include an analysis of system response from switching certain Facilities could result in Flicker concerns. The study will typically include system intact conditions (all facilities in-service) and contingency conditions (considering critical
outages on the System) to determine how the performance of the System at the Point of Interconnection changes for different system conditions. The criteria to be used during the switching analysis include:

- The relative steady state voltage change is limited to 3 percent of the nominal voltage for system intact conditions; and
- The relative steady state voltage change is limited to 5 percent of the nominal voltage for simulations involving a contingency condition.

Flicker tests for wind powered sources of generation shall be conducted in accordance with IEC 61000-4-15.

B. Harmonics

The harmonic distortion is defined as the ratio of the root mean square (rms) value of the harmonic to the rms value of the fundamental voltage or current. Harmonics can cause telecommunication interference, increase thermal heating in transformers, disable solid state equipment and create resonant overvoltages. In order to protect equipment from damage, harmonics must be managed and mitigated. The interconnection customer's interconnecting equipment shall not introduce excessive distortion to the Montana-Dakota System's voltage and current waveforms per IEEE 519-1992.

The harmonic distortion measurements shall be made at the Point of Interconnection between the interconnection customer and the Montana-Dakota System and shall be within the limits specified in the tables below. Montana-Dakota advises the interconnection customer to account for harmonics during the early planning and design stages of any interconnection project.

A special study will be required for situations when the fault to load ratio is less than 10.

Lower order harmonics, particularly the third and ninth harmonics, will often be of more concern to the interconnection customer. These are often related to Facility grounding, and to the type of transformer connections that may be involved. It is to the interconnection customer's advantage to work these problems out early enough so that interconnection customer and Montana-Dakota equipment can be acquired to achieve proper control.

XIV. Equipment Ratings (R2.1.11)

A. Generation Interconnections

For interconnected generation that meets the NERC registration criteria must comply with the NERC FAC-008 and FAC-009 standards for Facility Rating. Under this standard the interconnection customer must develop a Facility Rating Methodology (FRM) that addresses the elements that comprise the generating Facility. The interconnection customer must make that FRM available to Montana-Dakota upon request.

Through the course of the interconnection process, Montana-Dakota shall provide the Facility Ratings Methodology upon request of the Interconnection customer. In determining the appropriate equipment ratings of interconnection customer-owned Facilities, the interconnection customer must consider manufacturer specifications in the development of normal and emergency rating of each element comprising the Facility.

If the interconnection customer and Montana-Dakota each own elements that comprise the generating Facility, then that the generating Facility will be consider jointly for purpose of compliance with FAC-008 and FAC-009. For a joint own generating Facility each party will share with the other the rating of their respectively elements comprising the generating Facilities. Each party shall use the most limiting element rating in determining the rating of the jointly own generating Facility.

B. Transmission Interconnections

Interconnected transmission Facilities of 100kV or greater must comply with the NERC FAC-008 and FAC-009 standards for Facility Rating. Under this standard the interconnection customer must develop a Facility Rating Methodology (FRM) that addresses the elements that comprise the transmission Facility. The interconnection customer must make that FRM available to Montana-Dakota upon request.

Through the course of the interconnection process, Montana-Dakota shall provide the Facility Ratings Methodology upon request of the Interconnection customer. In determining the appropriate equipment ratings of interconnection customer-owned Facilities, the

interconnection customer must consider manufacturer specifications in the development of normal and emergency rating of each element comprising the Facility.

If the interconnection customer and Montana-Dakota each own elements that comprise the transmission Facility, then that transmission Facility will be considered jointly for purpose of compliance with FAC-008 and FAC-009. For a joint own transmission Facility each party will share with the other the rating of their respectively elements comprising the generating Facilities. Each party shall use the most limiting element rating in determining the rating of the jointly own generating Facility.

Upon the Interconnection customer's discretion and review of the Montana-Dakota facility ratings methodology, the Interconnection customer shall provide Facility ratings to Montana-Dakota for the Interconnection customer-owned equipment associated with the interconnection.

C. End User Interconnections

The Interconnection customer and Montana-Dakota must work closely during the interconnection process. Upon Montana-Dakota's acceptance of a valid interconnection application, the Interconnection customer must provide sufficient information to Montana-Dakota about the expected equipment ratings (MW, MVAR, kV, Amps, etc.) in order to derive accurate modeling of the interconnection Facilities in any studies and/or evaluations.

Through the course of the interconnection process, Montana-Dakota shall provide the Facility Ratings Methodology (on file within Montana-Dakota) to the Interconnection customer. The Interconnection customer shall review the Montana-Dakota Facility Ratings Document to understand Montana-Dakota's methodology of determining the appropriate equipment ratings.

In determining the appropriate equipment ratings of Interconnection customer-owned Facilities, the Interconnection customer must consider manufacturer specifications of each piece of equipment since they are the basis for determining appropriate equipment ratings. Upon the Interconnection customer's discretion and review of the Montana-Dakota facility ratings methodology, the Interconnection customer shall provide Facility ratings to Montana-Dakota for the Interconnection customer-owned equipment associated with the interconnection.

Montana-Dakota and the Interconnection customer shall jointly review their respective equipment and determine the most limiting equipment associated with the interconnection. The most limiting equipment (whether owned by the Interconnection customer or Montana-Dakota) shall dictate the overall rating of the interconnection equipment to be used in modeling for both real-time operations and planning studies.
All equipment needs to meet Montana-Dakota rating guidelines, which are established to meet NERC compliance. Equipment shall also meet applicable ANSI and/or IEEE standards.

XV. Synchronizing of Facilities (R2.1.12)

A. Synchronizing Relays

Synchronous generators and other generators with stand-alone capability must use one of the

following methods to synchronize with the Montana-Dakota System:

- Automatic synchronization with automatic synchronizing relay (Device 25) to synchronize with the Montana-Dakota System. The automatic synchronizing relay must have all of the following characteristics:
  - Slip frequency matching window of 0.1 Hz or less.
  - Voltage matching window of 10 percent or less.
  - Phase angle acceptance window of 10 degrees or less.
  - Breaker closure time compensation.

Note: The automatic synchronizing relay sends a close signal to the breaker after the above conditions are met.

- Automatic synchronization with automatic synchronizer (Device 15/25) to synchronize with the Montana-Dakota System. The automatic synchronizer must have all of the following characteristics:
  - Slip frequency matching window of 0.1 Hz or less.
  - Voltage matching window of .10 percent or less.
  - Phase angle acceptance window of .10 degrees or less.
  - Breaker closure time compensation. For an automatic synchronizer that does not have this feature, a tighter frequency window (5 degrees) with a one-second time acceptance window shall be used to achieve synchronization within .10 degrees phase angle.

Note: The automatic synchronizer has the ability to adjust generator voltage and frequency automatically to match system voltage and frequency, in addition to having the above characteristics.

- Manual synchronization with synchroscope and synch-check relay (Device 25) supervision. The synch-check relay must have the following characteristics:
  - Voltage matching window of 10 percent or less.
  - Phase angle acceptance window of .10 degrees or less.

Generators with greater than 1,000 kW aggregate nameplate rating must have automatic synchronizing relay or automatic synchronizer.

XVI. Maintenance Coordination (R2.1.13)

Interconnection customers that own transmission Protective Systems and generating Protective Systems that meet the NERC registration criteria must develop and implement a Protective Maintenance Program that complies with the NERC PRC standards.

Interconnection protective devices owned by the interconnection customer (as determined by the interconnection study process) should be maintained and inspected according to manufacturer recommendations and/or industry standards. Procedures must be established for visual and operational inspections. Additionally, provisions should be established for equipment maintenance and testing. Equipment should include, but not be limited to:

- Circuit Breakers
- Protective Relays
- Control Batteries
- P-Ts,

- Fuses,
- Switches,
- SCADA Equipment Metering

Montana-Dakota maintains the right to review maintenance, calibration and operation data of all protective equipment for the purpose of protecting Montana-Dakota facilities and other Montana-Dakota customers. The interconnection customer is responsible for providing the necessary test accessories (such as relay test plugs, instruction manuals, wiring diagrams, etc.) required to allow testing of protective devices. Verification may include the tripping of the intertie breaker.

If Montana-Dakota performs work on the interconnection customer's premises, an inspection of the work area may be made by Montana-Dakota. If hazardous working conditions are detected, the interconnection customer will be required to correct the unsafe conditions before Montana-Dakota will perform the work.

XVII. Operational Issues (R.2.1.14)

At Montana-Dakota's discretion, the interconnection customer will supply, at its expense, an operating study and any required operating guides completed in coordination with Montana-Dakota, Midwest ISO, the Applicable Reliability Council, and impacted transmission operators and balancing authorities. This would be required before energization of the Facility and must be updated as required. This operating study may result in operating guides.

A. Operating Guidelines

The interconnection customer shall operate its equipment within the guidelines of this handbook and any special requirements set forth by executed agreements with Montana-Dakota.

Montana-Dakota reserves the right to open the intertie circuit breaker or disconnect device for any of the following reasons:

- Montana-Dakota is performing hot line maintenance work on the Montana-Dakota System.
- Montana-Dakota System emergency. Inspection of the interconnection customer's equipment and protective equipment reveals a hazardous condition.
- Failure of the interconnection customer to provide maintenance and testing reports when required.
- The interconnection customer's equipment interferes with other customers or with the operation of the Montana-Dakota System.
- The interconnection customer has modified the equipment or protective devices without the knowledge or approval of Montana-Dakota.
- Operation, by interconnection customer, of any unapproved interconnection equipment. Personnel safety is threatened. Failure of the interconnection customer to comply with applicable OSHA Safety Tagging and
- Lockout requirements as well as Midwest ISO, Applicable Reliability Council, and Montana-Dakota switching guides and safety standards or any successor agency assuming or charged with similar responsibilities.

The failure of Montana-Dakota to open the intertie circuit breaker or disconnect device shall not serve to relieve the interconnection customer of any liability for injury, death or damage attributable to the negligence of the interconnection customer.

Changes to the Montana-Dakota System, or the addition of other customers with generation in the vicinity, may require modifications to the interconnection protective devices. If such changes are required, the interconnection customer may be subject to future charges for these modifications.

Operating criteria have been defined for interconnection customer Facilities interconnecting with the Montana-Dakota System in order to minimize adverse operating conditions to customers on the Montana-Dakota System. The interconnection technical requirements are outlined in this section and where applicable, requirements specific to size and/or type of interconnection are noted.

B. Frequency during Disturbances

Power system disturbances initiated by system events such as faults and forced equipment outages expose the system to oscillations in voltage and frequency. It is important that generators and lines remain in service for dynamic (transient) oscillations that are stable and damped.

To avoid large-scale blackouts that can result from excessive generation loss, major transmission loss, or load loss during a disturbance, underfrequency load shedding has been implemented by Montana-Dakota in accordance with requirements set forth by the Applicable Reliability Council. When system frequency declines, loads are automatically interrupted in steps. Load shedding is implemented to balance the generation and load. It is important that generators and lines remain connected to the system during frequency declines, both to limit the amount of load shedding required and to help the system avoid a complete collapse.

Additional voltage and frequency protection requirements for generators are found in Section VII.

C. Generator Frequency/Speed Control

1. 10 MW or Less

All interconnection customers generating equipment shall be designed to operate between 59.5 and 60.5 hertz. The operating frequency of the interconnection customer's generating equipment shall not deviate more than 0.5 hertz from a 60-hertz base.

For the detection of an island condition, generators must have a means of automatically disconnecting from the Montana-Dakota System within 0.2 seconds if the frequency cannot be maintained within 0.5 hertz.

2. 10 MW or Greater

The interconnection customer will operate its generator consistent with Montana-Dakota guidelines and requirements concerning frequency control. Generators shall be equipped with governors that sense frequency (unless exempt under NERC, Midwest ISO, or Applicable Reliability Council rules due to prime mover or regulatory limitations).

a. Interconnection customer generating equipment must have short-term capability for non-islanded low frequency operation not less than the following:

- 60.0 – 59.5 hertz continuous
- 59.5 – 59.3 hertz 10 minutes
- 59.3 – 58.7 hertz 10 seconds

Frequency relays must not constrain the operation of the generating facility to less than these values, unless agreed to by Montana-Dakota. The frequency relays must also be coordinated with Montana-Dakota and the Applicable Reliability Council or Midwest ISO Under-Frequency Load Shed Plan. To ensure "ride-through" capability of the Montana-Dakota System, the interconnection customer shall implement an under-frequency relay set point for the Facility no greater than 58.5 Hz.

3. Excitation System Requirements

An excitation system is required to regulate generator output voltage.

- Static systems shall have a minimum ceiling voltage of 150 percent of rated full load field voltage with 70 percent of generator terminal voltage and a maximum response time of two cycles (0.033 seconds).
- Rotating systems shall have an ANSI voltage response ratio of 2.0 or faster.
- Excitation systems shall respond to system disturbances equally in both the buck and boost directions.

Under certain conditions, Montana-Dakota may grant an exemption for generation Facilities that have excitation systems not meeting these requirements

XVIII. Inspection Requirements for Existing or New Facilities (R2.1.15)

A. Inspection, Test, Calibration and Maintenance

The interconnection customer has full responsibility for the inspection, testing, calibration and maintenance of their facilities, up to the Point of Interconnection, consistent with the Interconnection and Operating Agreement.

1. Pre-energization Inspection and Testing

Before initial energization, the interconnection customer shall develop an Inspection and Test Plan for pre-energization and energization testing. Montana-Dakota will review and approve the test plan prior to the test. Any costs incurred by Montana-Dakota as a result of the inspection and testing will be passed through to the interconnection customer. The interconnection customer will also be responsible for any additional tests that may be required by Montana-Dakota but were not specified in the interconnection customer's Inspection and Test Plan. The interconnection customer shall provide Montana-Dakota with copies of all drawings, specifications, and test records of the interconnection equipment and pertinent to the interconnected operation for Montana-Dakota's records.

The interconnection customer must have the interconnection installation inspected and certified by a qualified technician or a certified electrical state inspector for proper installation and operation of the interconnection protective devices. The inspection shall include, but not be limited to:

- Verification that the installation is in accordance with the study results from the interconnection study process.
- Verification of the proper operation of the protective schemes.

- Verification that the proper voltages and currents are applied to the interconnection protective relays.
- Verification of proper operation and settings of the interconnection protective relays.
- Verification of synchronizing equipment.
- Trip testing of the breaker(s) tripped by the interconnection relays.

XIX. Communications and Procedures during Normal and Emergency Operating Conditions (R2.1.16)

Prior to operation of any new interconnection (generation, tie-line or substation), the Interconnection customer must provide contact information to Montana-Dakota for the NERC certified operator of the Facilities.

The interconnection customer shall also arrange to get real-time SCADA data to the Midwest ISO according to the Midwest ISO protocols and data compatibility requirements. The interconnection customer may choose to utilize Montana-Dakota to perform this responsibility.

A. Dispatching and Maintenance

Montana-Dakota operates and maintains its system to provide reliable customer service while meeting the seasonal and daily peak loads even during equipment outages and disturbances. Project integration requires that the equipment at the Point of Interconnection not restrict timely outage coordination, automatic switching or equipment maintenance scheduling. Preserving reliable service to all Montana-Dakota customers is essential and may require additional switchgear, equipment redundancy, or bypass capabilities at the Point of Interconnection for acceptable operation of the System.

1. Emergency Response Requirement

The substation interconnection customer shall adhere to any load shedding directives by Montana-Dakota and insure coordination of load restoration with Montana-Dakota. The tie-line interconnection customer must make its facilities available to Montana-Dakota during emergencies as far as physically possible.

The generation interconnection customer shall make its generation available and adhere to reliability directives regarding the real or reactive output and on or off line status in compliance with the NERC standards. Unless the generator is out for maintenance or due to mechanical failure, the interconnection customer must be able to bring the unit to full output within the time specified in the emergency offer to the Midwest ISO. Failure to respond in a timely manner may result in financial penalties if such financial penalties are assessed by Midwest ISO and/or the Applicable Reliability Council.

The generator will be expected to supply up to maximum available reactive capability and/or to adjust generation levels including reducing to zero if requested by Montana-Dakota.

XX. Miscellaneous

A. Station Service

Power that is provided for local use at a substation to operate lighting, heat and auxiliary equipment is termed station service. Alternate station service is a backup source of power, used

only in emergencies or during maintenance when primary station service is not available.

Station service power is the responsibility of the interconnection customer. The station service requirements of the new Facilities, including voltage and reactive requirements shall not impose operating restrictions on the Montana-Dakota System beyond those specified in applicable NERC, Midwest ISO, and Applicable Reliability Council reliability criteria.

Appropriate provisions for station service and alternate station service will be determined during the interconnection process. Generally, a distribution transformer or station service voltage transformer (SSVT) within the substation will be the preferred provider of primary station service. The interconnection customer must provide metering for station service and alternate station service, as specified by the metering section of this handbook, or work out other acceptable arrangements.

B. Lighting

Substation lighting shall meet the requirements of the NESC. Controls for yard and control house lighting shall be accessible to Montana-Dakota at all times. Montana-Dakota standards for lighting are available upon request.

Appendix A: Revision History

Revision	Change Description	Revised by	Authorized by	Effective Date:

APPROVED BY: _____ DATE: 4/6/10

Henry Ford

Manager, Electric Transmission Engineering