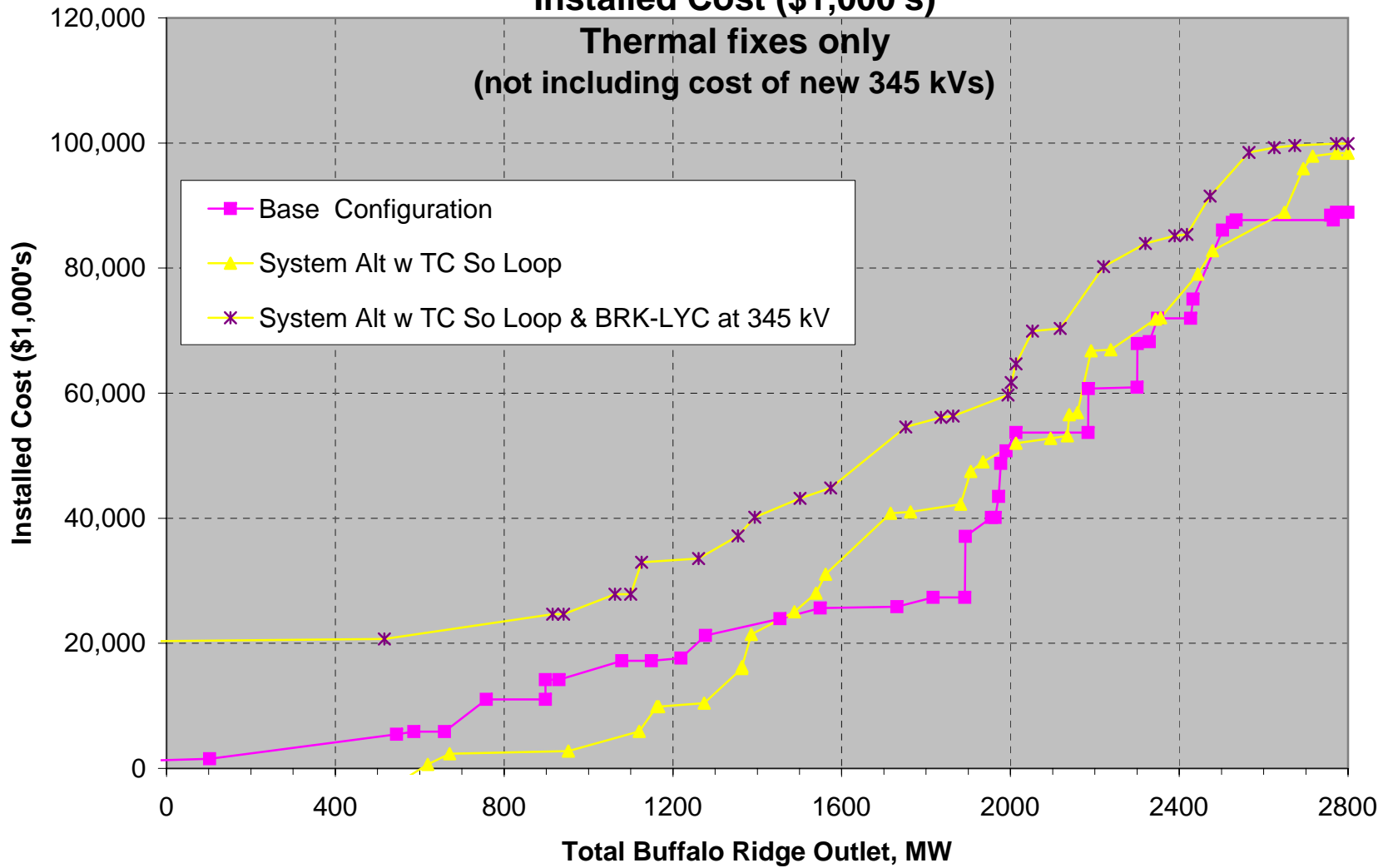


**SW Minnesota Generation Outlet
Installed Cost (\$1,000's)
Thermal fixes only
(not including cost of new 345 kVs)**



Southwest Minnesota-->Twin Cities EHV Development

"System Alternative" Configuration--Big Stone at 230 kV

Option 31A "incremental" improvements in service

Brookings Co-Lyon Co-Hazel-W Waconia-Blue Lk 345 kV

Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

With W Waconia-Helena-Lk Marion-Hampton Corner 345 kV "South Loop"

Key	SW MN Buffalo Ridge Area Generation			Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	Installed Cost, \$1,000's	
	TLTG Limit MW	Base Case MW	System Limit MW							item	cumulative
											19,770
	-1277	1200	-77	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0317	Conductor	Reconductor	4.4 mi	528	20,298
	-684	1200	516	Morris 230/115 kV tx #2 @ 130% of 100	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0219	transformer	install larger tx	1 ea	400	20,698
	-285	1200	915	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0176	Conductor	Rebuild	11.3 mi	3,955	24,653
	-259	1200	941	Lk Marion-Kenrick 115 @ 110% of 144	Blue Lk-Parkers Lk 345 & Blue Lk-Eden Prairie 345 & Eden Pr 345/115 tx #9	0.0289					24,653
	-137	1200	1063	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0237	Conductor	Reconductor	26.5 mi	3,180	27,833
8	-100	1200	1100 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0228				0	27,833
	-74	1200	1126	Maynard-Kerhoven 115 @ 110% of 78	Granite Falls-Willmar 230	0.0204	Conductor	Rebuild	14.7 mi	5,145	32,978
	61	1200	1261	Dakota Heights-Kenrick 115 @ 110% of 144	Blue Lk-Parkers Lk 345 & Blue Lk-Eden Prairie 345 & Eden Pr 345/115 tx #9	0.0289	Conductor	Reconductor	4.7 mi		33,542
										564	
14	154	1200	1354	Minn Valley-Panther 230 @ 110% of 388	Hazel-W Waconia 345	0.0870	Conductor	Reconductor	30.2 mi	3,624	37,166
	194	1200	1394	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0214	Transformer	Install 2nd tx	1 ea	3,000	40,166
#	301	1200	1501	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0802	Transformer	Replace tx	1 ea	3,000	43,166
					Brookings Co-Toronto 115						
13	374	1200	1574	Canby-Burr 115 @ 110% of 97	Brookings Co-Toronto 115	0.1069	Conductor	Rebuild	4.8 mi	1,680	44,846
19	552	1200	1752	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Hazel-W Waconia 345	0.3435	Conductor	Reconductor	54.2 mi	9,756	54,602
18	635	1200	1835	St Cloud TpW-Wakefield 115 @ 110% of 113	Hazel-W Waconia 345	0.0506	Conductor	Reconductor	13.8 mi	1,518	56,120
21	664	1200	1864	Henning-Fergus Fl 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0416	Term equip	Replace equip	2 ea	200	56,320
22	794	1200	1994	McLeod-Panther 230 @ 110% of 388	Hazel-W Waconia 345	0.0871	Conductor	Reconductor	28.2 mi	3,384	59,704
	802	1200	2002	Brookings Co 345/115 tx 1 or 2 @ 130% of 448	Brookings Co 345/115 tx 2 or 1	0.3086		Install larger txs	2.0 ea	2,000	61,704
16	813	1200	2013	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	64,668
	852	1200	2052	Sheyenne-Audubon 230 @ 110% of 320	Wahpeton-Fergus Falls 230	0.0343	Conductor	Reconductor	43.9 mi	5,268	69,936
	918	1200	2118	Burnsville-Dakota Heights 115 @ 110% of 144	Blue Lk-Parkers Lk 345 & Blue Lk-Eden Prairie 345 & Eden Pr 345/115 tx #9	0.0289	Conductor	Reconductor	3.6 mi		70,368
										432	
	1021	1200	2221	Wilmarth-Helena 345 @ 110% of 1165	Hazel-W Waconia 345	0.3168	Conductor	Reconductor	54.8 mi	9,864	80,232
	1120	1200	2320	Granite Falls-Willmar 230 @ 110% of 388	Hazel-W Waconia 345	0.0707	Conductor	Reconductor	31.0 mi	3,720	83,952
	1189	1200	2389	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0547	Conductor	Install larger wire	24.7 mi	1,235	85,187
	1218	1200	2418	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0398	Term Equip	Replace equip	2.0 ea	200	85,387
	1273	1200	2473	McLeod-Blue Lk 230 @ 110% of 388	Hazel-W Waconia 345	0.0644	Conductor	Reconductor	51.0 mi	6,120	91,507
	1365	1200	2565	Loon Tp-Eastwood 115 @ 110% of 310	Lk Marion 345/115 tx	0.0357	Conductor	Install 2nd tx	1.0 ea	7,000	98,507
	1425	1200	2625	Johnson Jct-Morris 230 @ 110% of 390	Hazel-Canby 230	0.0547	Conductor	Install larger wire	15.4 mi	770	99,277
	1474	1200	2674	Big Stone-Ortonville 230 @ 110% of 390	Watertown-Granite Falls 230 & Blair-Granite Falls 230	0.0290	Conductor	Install larger wire	6.5 mi	325	99,602
	1572	1200	2772	Granite Falls-Minn Valley 230 @ 110% of 388	Hazel-Canby 230	0.0527	Conductor	Reconductor	2.5 mi	300	99,902
	1600	1200	2800	(none)						0	99,902

Notes

1. TLTG analysis run on Summer 2011 off-peak powerflow case representing 1200 MW of "existing" Buffalo Ridge area gen.
Total SW MN Buffalo Ridge area gen = 1168 + 32 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Lyon Co 115 kV, Lyon Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV, 2nd Brookings Co 345/115 tx
Granite Falls-Willmar 230 kV uprated to 388 MVA (conductor thermal rating)
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 230 kV (345 kV const), Hazel-Granite Falls/Minn Valley 230 kV.
8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE
10/5/2005

Presumed facility addition/upgrade costs (\$1,000's)

Reconductor to 795 kcm ACSS	120		
Reconductor to 2 x 795 kcm ACSS	180		
Reconductor to 477 kcm ACSS	110		
Reconductor to 477 kcm ACSR	100		
		69 kV	115 kV 230 kV
Rebuild to 795 kcm ACSS single ckt			350
Rebuild to 2 x 795 kcm ACSS single ckt			500

		<u>qty</u>	<u>each</u>	<u>totals</u>
Base Costs for this Option:	Brookings Co-Lyon Co 245 kV	49.0 mi	800	39,200
	Lyon Co-Hazel 345 kV	22.0 mi	800	17,600
	Lyon Co-Hazel: remove existing 115 kV	22.0 mi	40	880
	Hazel-W Waconia-Blue Lk 345 kV	113 mi	800	90,400
	Hazel-Minn Valley 230 kV	8 mi	450	3,600
	Hazel-Minn Valley: remove existing 115 kV	8 mi	40	320
	Yankee-Brookings Co 115 kV #2 (620 MVA)	14.0 mi	500	7,000
	Brookings Co-Toronto 115 kV (310 MVA)	20.0 mi	350	7,000
	Minn Valley 230 kV line re-arrangements	1.0 ea	2,000	2,000
	Helena-Lk Marion-Hampton Corner 345 kV	34.0 mi	800	27,200
	W Waconia-Helena 345 kV	26.0 mi	800	20,800
	Subtotal (lines)			216,000
	Brookings Co: add 2nd 345/115 kV 448 MVA tx	1.0 ea	6,000	6,000
	Brookings Co: add 345 kV line term (for Lyon Co)	1.0 ea	1,500	1,500
	Brookings Co: add 115 kV line term (for YKE)	1.0 ea	1,000	1,000
	Brookings Co: add 115 kV line term (for Toronto)	1.0 ea	1,000	1,000
	Brookings Co: add 2 x 40 MVAR 115 kV shunt cap	2.0 ea	750	1,500
	Brookings Co: add 50 MVAR shunt reactor	1.0 ea	1,200	1,200
	Lyon Co: Add 4-position 345 kV ring bus	1.0 ea	6,000	6,000
	Lyon Co: Add 345/115 kV 448 MVA tx	1.0 ea	6,000	6,000
	Lyon Co: add 50 MVAR shunt reactor	1.0 ea	1,200	1,200
	Lyon Co: add 1 x 40 MVAR shunt cap	1.0 ea	750	750
	Lyon Co: upgrade 2 x 30-->2 x 40 MVAR shunt ca	2.0 ea	25	50

Southwest Minnesota-->Twin Cities EHV Development

"System Alternative" Configuration--Big Stone at 230 kV

Option 31A "incremental" improvements in service

Brookings Co-Lyon Co 115 kV & Lyon Co-Hazel-W Waconia-Blue Lk 345 kV

Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

With W Waconia-Helena-Lk Marion-Hampton Corner 345 kV "South Loop"

Key	SW MN Buffalo Ridge Area Generation			Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	Installed Cost, \$1,000's	
	TLTG Limit MW	Base Case MW	System Limit MW							item	cumulative
	-1329	1200	-129	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0328	Conductor	Reconductor	4.4 mi	528	-7,480
	-752	1200	448	Morris 230/115 kV tx #2 @ 130% of 100	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0227	transformer	install larger tx	1 ea	400	-6,952
13	-581	1200	619	Granite Falls-Morris 230 @ 110% of 239	Hazel-Canby 230	0.0192	Conductor	Reconductor	60.0 mi	7,200	648
	-529	1200	671	Canby-Burr 115 @ 110% of 97	Canby-Big Stone 230	0.0277	Conductor	Rebuild	4.8 mi	1,680	2,328
	-248	1200	952	Lk Marion-Kenrick 115 @ 110% of 144	Blue Lk-Parkers Lk 345 & Blue Lk-Eden	0.0288	Conductor	Reconductor	3.5 mi		2,748
					Prairie 345 & Eden Pr 345/115 tx #9					420	
	-80	1200	1120	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0235	Conductor	Reconductor	26.5 mi	3,180	5,928
8	-38	1200	1162	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0163	Conductor	Rebuild	11.3 mi	3,955	9,883
	-34	1200	1166	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0223				0	9,883
	74	1200	1274	Dakota Heights-Kenrick 115 @ 110% of 144	Blue Lk-Parkers Lk 345 & Blue Lk-Eden	0.0288	Conductor	Reconductor	4.7 mi		10,447
					Prairie 345 & Eden Pr 345/115 tx #9					564	
	163	1200	1363	Blair-Granite Falls 230 @ 110% of 398	Hazel-Canby 230	0.0576	Conductor	Reconductor	46.0 mi	5,520	15,967
	164	1200	1364	Granite Falls-Minn Valley 230 @ 110% of 388	Hazel-Canby 230	0.0622	Conductor	Reconductor	2.5 mi	300	16,267
	186	1200	1386	Maynard-Kerhoven 115 @ 110% of 78	Granite Falls-Willmar 230	0.0190	Conductor	Rebuild	14.7 mi	5,145	21,412
14	288	1200	1488	Minn Valley-Panther 230 @ 110% of 388	Hazel-W Waconia 345	0.0830	Conductor	Reconductor	30.2 mi	3,624	25,036
	339	1200	1539	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0206	Transformer	Install 2nd tx	1 ea	3,000	28,036
#	362	1200	1562	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0787	Transformer	Replace tx	1 ea	3,000	31,036
19	516	1200	1716	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Hazel-W Waconia 345	0.3488	Conductor	Reconductor	54.2 mi	9,756	40,792
21	563	1200	1763	Henning-Fergus Fl 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0430	Term equip	Replace equip	2 ea	200	40,992
	682	1200	1882	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0617	Conductor	Install larger wire	24.7 mi	1,235	42,227
	706	1200	1906	Sheyenne-Audubon 230 @ 110% of 320	Wahpeton-Fergus Falls 230	0.0359	Conductor	Reconductor	43.9 mi	5,268	47,495
18	735	1200	1935	St Cloud TpW-Wakefield 115 @ 110% of 113	Hazel-W Waconia 345	0.0490	Conductor	Reconductor	13.8 mi	1,518	49,013
16	813	1200	2013	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	51,977
	895	1200	2095	Johnson Jct-Morris 230 @ 110% of 390	Hazel-Canby 230	0.0617	Conductor	Install larger wire	15.4 mi	770	52,747
	935	1200	2135	Burnsville-Dakota Heights 115 @ 110% of 14	Blue Lk-Parkers Lk 345 & Blue Lk-Eden	0.0288	Conductor	Reconductor	3.6 mi		53,179
					Prairie 345 & Eden Pr 345/115 tx #9					432	
22	939	1200	2139	McLeod-Panther 230 @ 110% of 388	Hazel-W Waconia 345	0.0832	Conductor	Reconductor	28.2 mi	3,384	56,563
	959	1200	2159	Big Stone-Ortonville 230 @ 110% of 390	Watertown-Granite Falls 230 & Blair-Granite Falls 230	0.0290	Conductor	Install larger wire	6.5 mi	325	56,888
	991	1200	2191	Wilmarth-Helena 345 @ 110% of 1165	Hazel-W Waconia 345	0.3204	Conductor	Reconductor	54.8 mi	9,864	66,752
	1038	1200	2238	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0418	Term Equip	Replace equip	2.0 ea	200	66,952
	1144	1200	2344	Heron Lk-Brewster 161 @ 110% of 112	Nobles Co-Lakefield Jct 345	0.0294	Conductor	Rebuild	14.0 mi	4,900	71,852
	1156	1200	2356	Marshall SS-Marshall SE 115 @ 110% of 128	Erie Rd-Saratoga 115	0.0333	Conductor	Reconductor	1.7 mi	204	72,056
	1244	1200	2444	Loon Tp-Eastwood 115 @ 110% of 310	Lk Marion 345/115 tx	0.0400	Conductor	Install 2nd tx	1.0 ea	7,000	79,056
	1279	1200	2479	Granite Falls-Willmar 230 @ 110% of 388	Hazel-W Waconia 345	0.0678	Conductor	Reconductor	31.0 mi	3,720	82,776
	1449	1200	2649	McLeod-Blue Lk 230 @ 110% of 388	Hazel-W Waconia 345	0.0614	Conductor	Reconductor	51.0 mi	6,120	88,896
	1494	1200	2694	Lakefield Jct 345/161 txs @ 130% of 335	Wilmarth-Lakefield Gen 345	0.0682	transformers	Replace txs	2.0 ea	7,000	95,896
	1516	1200	2716	Brookings Co 345/115 tx 1 or 2 @ 130% of 4	Brookings Co 345/115 tx 2 or 1	0.2543		Install larger txs	2.0 ea	2,000	97,896

1572	1200	2772	Triboji-Spencer 161 @ 110% of 195	Wilmarth-Lakefield 345	0.0384	Conductor	Reconductor	4.0 mi	480	98,376
1600	1200	2800	(none)						0	98,376

Notes

1. TLTG analysis run on Summer 2011 off-peak powerflow case representing 1200 MW of "existing" Buffalo Ridge area gen.
Total SW MN Buffalo Ridge area gen = 1168 + 32 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Lyon Co 115 kV, Lyon Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV, 2nd Brookings Co 345/115 tx Granite Falls-Willmar 230 kV uprated to 388 MVA (conductor thermal rating)
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 230 kV (345 kV const), Hazel-Granite Falls/Minn Valley 230 kV.
8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

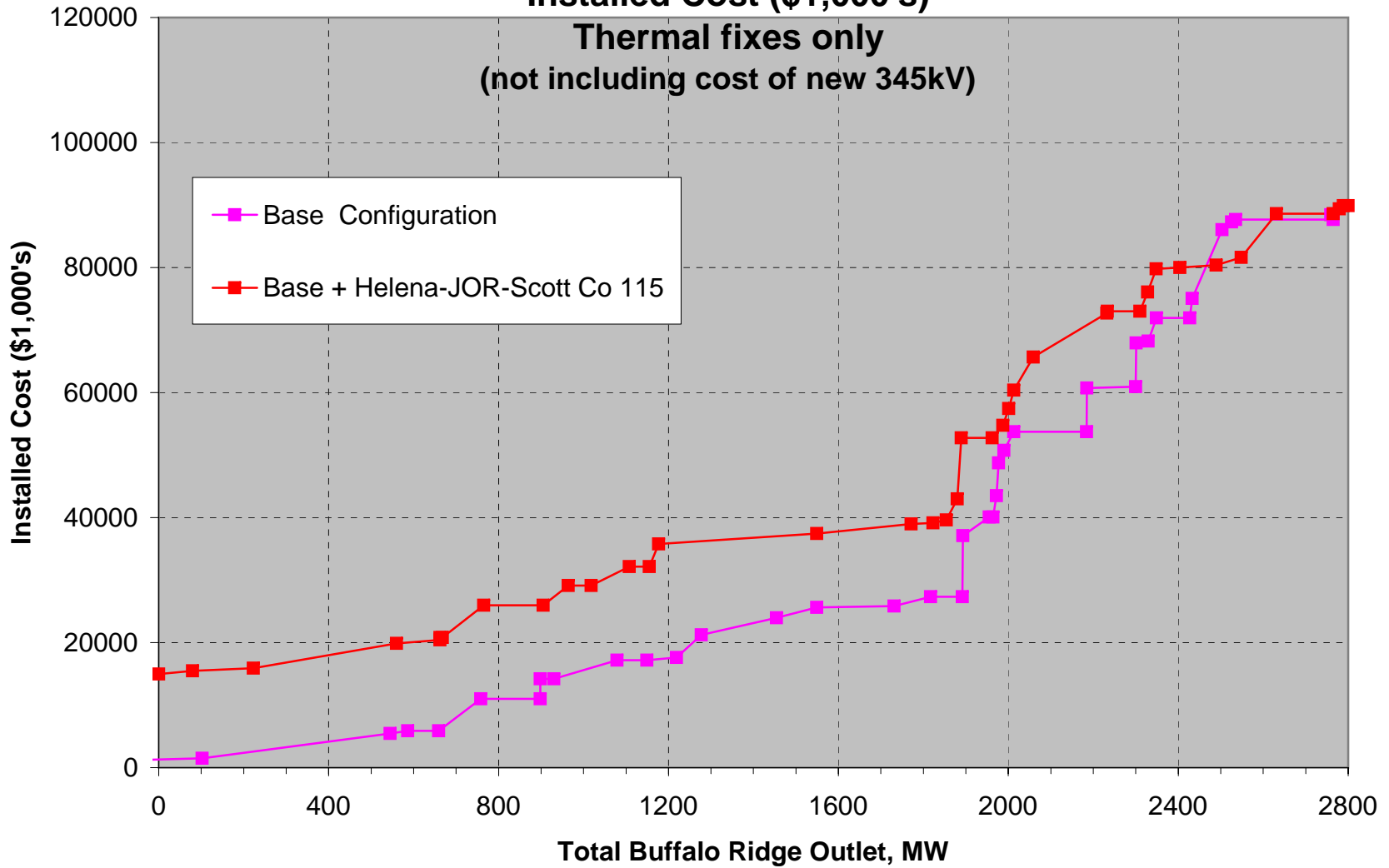
R Gonzalez, PE
10/5/2005

Presumed facility addition/upgrade costs (\$1,000's)

Reconductor to 795 kcm ACSS				120
Reconductor to 2 x 795 kcm ACSS				180
Reconductor to 477 kcm ACSS				110
Reconductor to 477 kcm ACSR				100
	69 kV	115 kV	230 kV	
Rebuild to 795 kcm ACSS single ckt				350
Rebuild to 2 x 795 kcm ACSS single ckt				500

Base Costs for this Option:		qty	each	totals
Brookings Co-Lyon Co 115 kV		49.0 mi	350	17,150
Lyon Co-Hazel 345 kV		22.0 mi	800	17,600
Lyon Co-Hazel: remove existing 115 kV		22.0 mi	40	880
Hazel-W Waconia-Blue Lk 345 kV		113 mi	800	90,400
Hazel-Minn Valley 230 kV		8 mi	450	3,600
Hazel-Minn Valley: remove existing 115 kV		8 mi	40	320
Yankee-Brookings Co 115 kV #2 (620 MVA)		14.0 mi	500	7,000
Brookings Co-Toronto 115 kV (310 MVA)		20.0 mi	350	7,000
Minn Valley 230 kV line re-arrangements		1.0 ea	2,000	2,000
Helena-Lk Marion-Hampton Corner 345 kV		34.0 mi	800	27,200
W Waconia-Helena 345 kV		26.0 mi	800	20,800
	Subtotal (lines)			193,950
Brookings Co: add 2nd 345/115 kV 448 MVA tx		1.0 ea	6,000	6,000
Brookings Co: add 115 kV line term (for Lyon Co)		1.0 ea	1,000	1,000
Brookings Co: add 115 kV line term (for YKE)		1.0 ea	1,000	1,000
Brookings Co: add 115 kV line term (for Toronto)		1.0 ea	1,000	1,000
Brookings Co: add 2 x 40 MVAR 115 kV shunt cap		2.0 ea	750	1,500

**SW Minnesota Generation Outlet
Installed Cost (\$1,000's)
Thermal fixes only
(not including cost of new 345kV)**



Southwest Minnesota-->Twin Cities EHV Development

Base Configuration--Big Stone at 230 kV

Option 31A "incremental" improvements in service

Brookings Co-Lyon Co-Franklin-Helena-Lk Marion-Hampton Corner single circuit
with Lyon Co-Hazel 345 kV

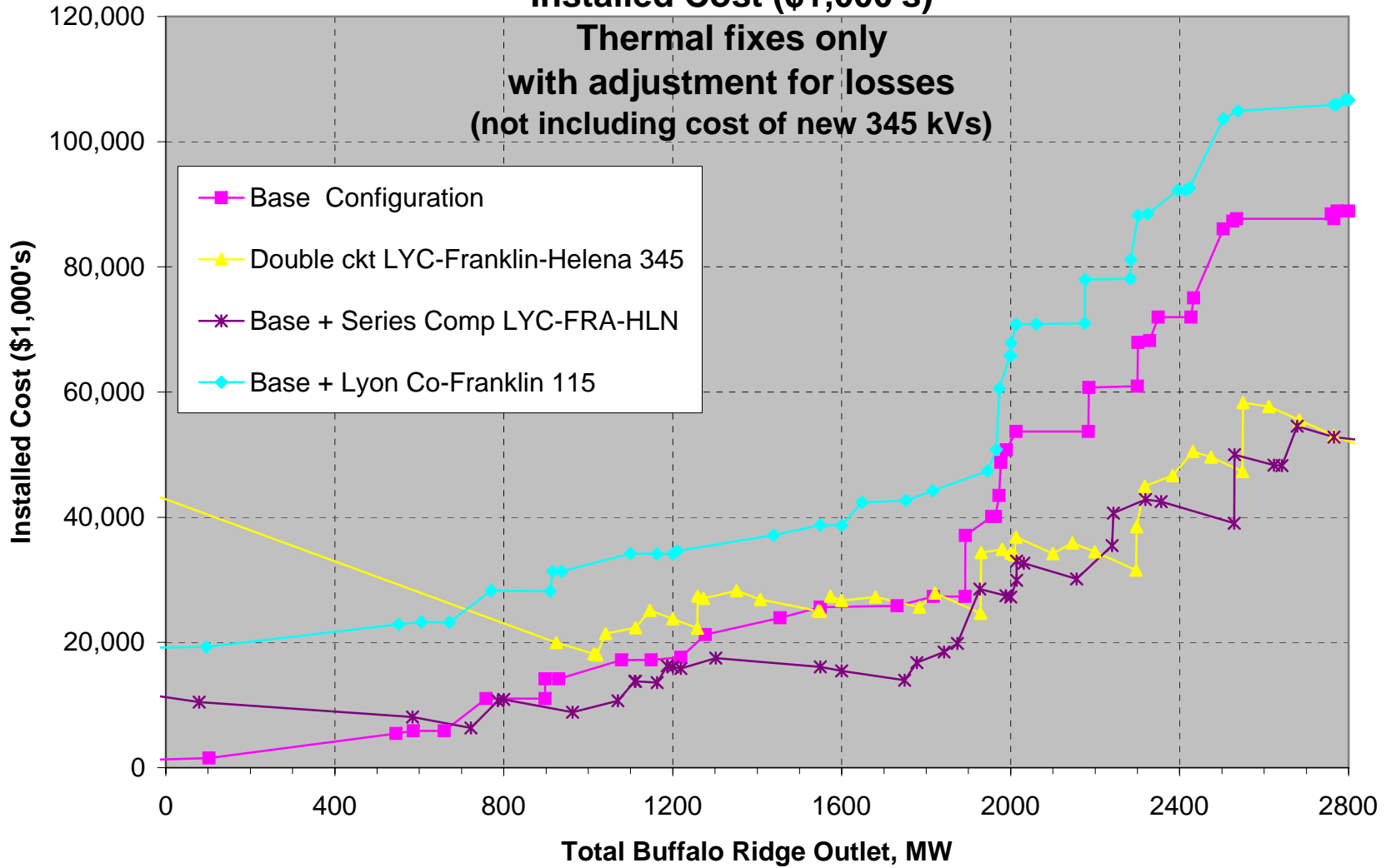
Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

With Helena 345/115 kV tx & Helena-Jordan-Scott Co 115 kV

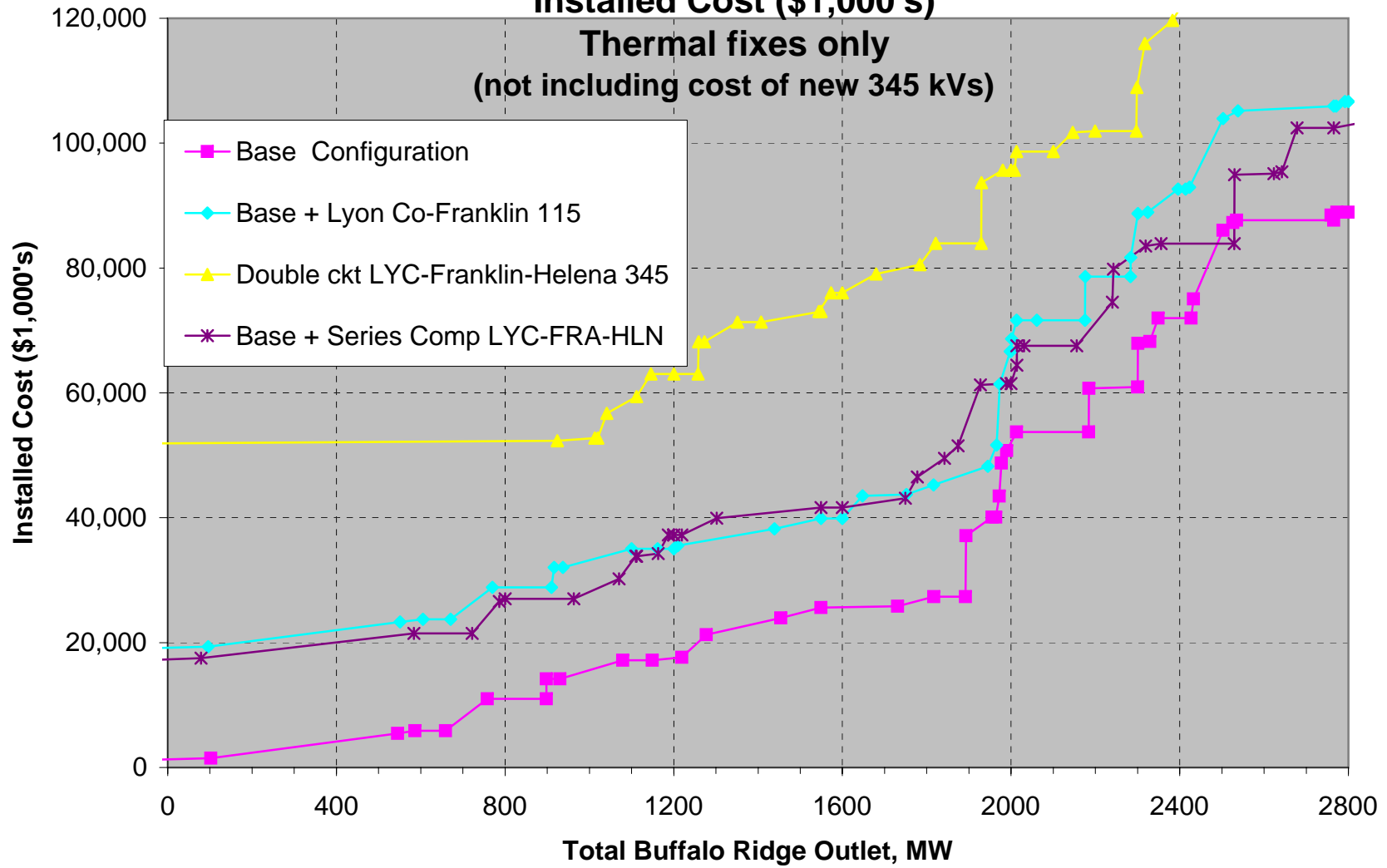
SW MN Buffalo Ridge Area Generation						distribution	Limiting	Remedy	qty	Installed Cost, \$1,000's	
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	factor	factor			item	cumulative
			0					Install facilities			14,950
5	-1120	1200	80	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0330	Conductor	Reconductor	4.4 mi	528	15,478
2	-977	1200	223	Lake Marion-Kenrick 115 @ 110% of 139	Airlake-Lk Marion 115	0.0208	Conductor	Reconductor	3.5 mi	420	15,898
9	-640	1200	560	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0179	Conductor	Rebuild	11.3 mi	3,955	19,853
	-538	1200	662	Kenrick-Dakota Heights 115 @ 110% of 139	Airlake-Lk Marion 115	0.0208	Conductor	Reconductor	4.7 mi	564	20,417
	-538	1200	662	Morris 230/115 kV tx #2 @ 130% of 100	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0222	transformer	install larger tx	1 ea	400	20,817
3	-532	1200	668	Paynesville-Roscoe 69 @ 110% of 47	Paynesville-Wakefield 115	0.0179	Conductor	(Opt 31A facility)		0	20,817
4	-435	1200	765	Maynard-Kerkhoven Tp 115 @ 110% of 78	Granite Falls-Willmar 230	0.0217	Conductor	Rebuild	14.7 mi	5,145	25,962
7	-295	1200	905	Roscoe-Munson 69 @ 110% of 47	Paynesville-Wakefield 115	0.0179	Conductor	(Opt 31A facility)		0	25,962
	-236	1200	964	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0250	Conductor	Reconductor	26.5 mi	3,180	29,142
8	-182	1200	1018 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0240				0	29,142
10	-92	1200	1108	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0225	Transformer	Install 2nd tx	1 ea	3,000	32,142
11	-45	1200	1155	Farm Tp-Munson Tp @ 110% of 47	Paynesville-Wakefield 115	0.0179	Conductor	(Opt 31A facility)		0	32,142
14	-23	1200	1177	Minn Valley-Panther 230 @ 110% of 388	Lyon Co-Franklin 345	0.0869	Conductor	Reconductor	30.2 mi	3,624	35,766
13	347	1200	1549	Canby-Burr 115 @ 110% of 97	Brookings Co-Toronto 115	0.1078	Conductor	Rebuild	4.8 mi	1,680	37,446
18	571	1200	1771	St Cloud TpW-Wakefield 115 @ 110% of 113	Franklin-Helena 345	0.0505	Conductor	Reconductor	13.8 mi	1,518	38,964
21	623	1200	1823	Henning-Fergus FI 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0431	Term equip	Replace equip	2 ea	200	39,164
20	654	1200	1854	Burnsville-Dakota Hgts @ 110% of 139	Airlake-Lk Marion 115	0.0223	Conductor	Reconductor	3.6 mi	432	39,596
22	680	1200	1880	McLeod-Panther 230 @ 110% of 388	Franklin-Helena 345	0.0870	Conductor	Reconductor	28.2 mi	3,384	42,980
17	689	1200	1889	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Lyon Co-Franklin 345	0.3348	Conductor	Reconductor	54.2 mi	9,756	52,736
19	762	1200	1962 R	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Franklin-Helena 345	0.3323				0	52,736
	787	1200	1987	Brookings Co 345/115 tx 1 or 2 @ 130% of 44	Brookings Co 345/115 tx #2 or 1	0.3096	Transformer	Install larger txs	2 ea	2,000	54,736
15	801	1200	2001	Helena-Blue Lk 345 @ 110% of 1165	Helena-Lk Marion 345	0.3636	Conductor	Reconductor	15.0 mi	2,700	57,436
16	813	1200	2013	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	60,400
	859	1200	2059	Sheyenne-Audubon 230 @ 110% of 320	Wahpeton-Fergus Falls 230	0.0355	Conductor	Reconductor	43.9 mi	5,268	65,668
24	1032	1200	2232	Wilmarth-Helena 345 @ 110% of 1165	Franklin-Helena 345	0.3150	Conductor	Reconductor	39.0 mi	7,020	72,688
	1033	1200	2233	Granite Falls-Minn Valley 230 @ 110% of 388	Hazel-Minn Valley 230	0.0604	Conductor	Reconductor	2.5 mi	300	72,988
	1110	1200	2310	Winnebago-Winnebago S 161 @ 110% of 161	Prairie Island-Byron 345	0.0224	??			0	72,988
	1128	1200	2328	Ft Ridgely-Franklin 115 @ 110% of 139	Franklin-Helena 345	0.0281	Conductor	Reconductor	25.7 mi	3,084	76,072
1	1148	1200	2348	Granite Falls-Willmar 230 @ 110% of 388	Minn Valley-Panther 230	0.0664	Conductor	Reconductor	31.0 ea	3,720	79,792
	1204	1200	2404	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0409	Term Equip	Replace equip	2.0 ea	200	79,992
	1289	1200	2489	Minn Valley-Hazel 230 @ 110% of 388	Lyon Co-Franklin 345	0.0961	Conductor	Install larger wire	8.0 mi	400	80,392
	1348	1200	2548	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0539	Conductor	Install larger wire	24.7 mi	1,235	81,627
	1431	1200	2631	Loon Tp-Eastwood 115 @ 110% of 310	Lk Marion 345/115 tx	0.0376	Conductor	Add 2nd tx	1.0 ea	7,000	88,627
	1548	1200	2765 R	Brookings Co 345/115 txs @ 100% of 448	(system intact)	0.1700	transformers			0	88,627
	1579	1200	2779	Johnson Jct-Morris 230 @ 110% of 390	Hazel-Canby 230	0.0539	Conductor	Install larger wire	15.4 mi	770	89,397
	1589	1200	2789	Triboji-Spencer 161 @ 110% of 195	Wilmarth-Lakefield 345	0.0372	Conductor	Reconductor	4.0 mi	480	89,877
	1600	1200	2800	(none)						0	89,877

SW Minnesota Generation Outlet Installed Cost (\$1,000's)

Thermal fixes only
with adjustment for losses
(not including cost of new 345 kV's)



**SW Minnesota Generation Outlet
Installed Cost (\$1,000's)
Thermal fixes only
(not including cost of new 345 kV's)**



Southwest Minnesota-->Twin Cities EHV Development

**Base Configuration--Big Stone at 230 kV
With Double Circuit Lyon Co-Franklin-Helena 345 kV**

Option 31A "incremental" improvements in service
Brookings Co-Lyon Co-Franklin-Helena-Lk Marion-Hampton Corner single circuit
with Lyon Co-Hazel 345 kV

Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

SW MN Buffalo Ridge Area Generation										Installed Cost, \$1,000's	
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	item	cumulative c
								Incremental cost of 2nd ckt			50,400
5	-1639	1200	-439	Lake Marion-Kenrick 115 @ 110% of 139	Airlake-Lk Marion 115	0.0238	Conductor	Reconductor	3.5 mi	420	50,820
	-1268	1200	-68	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0328	Conductor	Reconductor	4.4 mi	528	51,348
9	-1233	1200	-33	Kenrick-Dakota Heights 115 @ 110% of 139	Airlake-Lk Marion 115	0.0238	Conductor	Reconductor	4.7 mi	564	51,912
	-276	1200	924	Morris 230/115 kV tx #2 @ 130% of 100	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0205	transformer	install larger tx	1 ea	400	
20	-187	1200	1013	Burnsville-Dakota Hgts @ 110% of 139	Airlake-Lk Marion 115	0.0238	Conductor	Reconductor	3.6 mi	432	52,312
3	-180	1200	1020	Paynesville-Roscoe 69 @ 110% of 47	Paynesville-Wakefield 115	0.0160	Conductor	(Opt 31A facility)		0	52,744
2	-159	1200	1041	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0164	Conductor	Rebuild	11.3 mi	3,955	56,699
15	-88	1200	1112	Helena-Blue Lk 345 @ 110% of 1165	Helena-Lk Marion 345	0.4262	Conductor	Reconductor	15.0 mi	2,700	59,399
14	-54	1200	1146	Minn Valley-Panther 230 @ 110% of 388	Lyon Co-Franklin 345 # 1 & 2	0.0873	Conductor	Reconductor	30.2 mi	3,624	63,023
			1200								63,023
			1258								63,023
4	59	1200	1259	Maynard-Kerkhoven Tp 115 @ 110% of 78	Granite Falls-Willmar 230	0.0190	Conductor	Rebuild	14.7 mi	5,145	68,168
7	73	1200	1273	Roscoe-Munson 69 @ 110% of 47	Paynesville-Wakefield 115	0.0160	Conductor	(Opt 31A facility)		0	68,168
	151	1200	1351	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0225	Conductor	Reconductor	26.5 mi		
										3,180	71,348
8	207	1200	1407 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0216				0	71,348
13	331	1200	1549	Canby-Burr 115 @ 110% of 97	Brookings Co-Toronto 115	0.1083	Conductor	Rebuild	4.8 mi	1,680	73,028
11	344	1200	1544	Farm Tp-Munson Tp @ 110% of 47	Paynesville-Wakefield 115	0.0160	Conductor	(Opt 31A facility)		0	73,028
10	373	1200	1573	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0200	Transformer	Install 2nd tx	1 ea	3,000	76,028
			1600								76,028
	480	1200	1680	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0789	Transformer	Replace tx	1 ea		
										3,000	79,028
18	584	1200	1784	St Cloud TpW-Wakefield 115 @ 110% of 113	Franklin-Helena 345 #1 & 2	0.0505	Conductor	Reconductor	13.8 mi	1,518	80,546
22	621	1200	1821	McLeod-Panther 230 @ 110% of 388	Franklin-Helena 345 #1 & 2	0.0870	Conductor	Reconductor	28.2 mi	3,384	83,930
			1929								83,930
17	730	1200	1930	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Lyon Co-Franklin 345 # 1 & 2	0.3330	Conductor	Reconductor	54.2 mi	9,756	93,686
	780	1200	1980	Brookings Co 345/115 tx 1 or 2 @ 130% of 44	Brookings Co 345/115 tx #2 or 1	0.3101	Transformer	Install larger txs	2 ea	2,000	95,686
			2000								95,686
19	808	1200	2008 R	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Franklin-Helena 345 #1 & 2	0.3307				0	95,686
16	813	1200	2013	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	98,650
	900	1200	2100	Winnebago-Winnebago S 161 @ 110% of 16	Prairie Island-Byron 345	0.0224	??			0	98,650
	946	1200	2146	Ft Ridgely-Franklin 115 @ 110% of 139	Franklin-Helena 345 #1 & 2	0.0291	Conductor	Reconductor	25.7 mi	3,084	101,734
21	999	1200	2199	Henning-Fergus FI 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0395	Term equip	Replace equip	2 ea	200	101,934
			2297								101,934
	1098	1200	2298	Loon Tp-Eastwood 115 @ 110% of 310	Lk Marion 345/115 tx	0.0384	Conductor	Add 2nd tx	1.0 ea	7,000	108,934
24	1117	1200	2317	Wilmarth-Helena 345 @ 110% of 1165	Franklin-Helena 345 #1 & 2	0.3132	Conductor	Reconductor	39.0 mi	7,020	115,954
1	1183	1200	2383	Granite Falls-Willmar 230 @ 110% of 388	Minn Valley-Panther 230	0.0691	Conductor	Reconductor	31.0 ea	3,720	119,674
	1231	1200	2431	Sheyenne-Audubon 230 @ 110% of 320	Wahpeton-Fergus Falls 230	0.0326	Conductor	Reconductor	43.9 mi	5,268	124,942
	1274	1200	2474	Minn Valley-Hazel 230 @ 110% of 388	Lyon Co-Franklin 345 # 1 & 2	0.0967	Conductor	Install larger wire	8.0 mi	400	125,342

		2549								125,342
1350	1200	2550	Loon Tp-Eastwood 115 @ 110% of 310	Helena-Blue Lk 345	0.0475	Conductor	Rebuild to 600 MVA	22.0 mi	11,000	136,342
1411	1200	2611	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0533	Conductor	Install larger wire	24.7 mi	1,235	137,577
1483	1200	2683	Lk Marion 345/115 tx @ 130% of 448	Helena-Blue Lk 345	0.0581	Transformer	(added 2nd tx)		0	137,577
1540	1200	2765 R	Brookings Co 345/115 txs @ 100% of 448	(system intact)	0.1700	transformers			0	137,577
1612	1200	2812	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0377	Term Equip	Replace equip	2.0 ea	200	137,777
1643	1200	2843	Johnson Jct-Morris 230 @ 110% of 390	Hazel-Canby 230	0.0533	Conductor	Install larger wire	15.4 mi	770	138,547
1700	1200	2900	(none)						0	138,547

Notes

1. TLTG analysis run on Summer 2011 off-peak powerflow case representing 1200 MW of "existing" Buffalo Ridge area gen.
Total SW MN Buffalo Ridge area gen = 1168 + 32 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV, 2nd Brookings Co 345/115 tx Granite Falls-Willmar 230 kV uprated to 388 MVA (conductor thermal rating)
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 230 kV (345 kV const), Hazel-Granite Falls/Minn Valley 230 kV.
8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE

9/7/2005

Presumed facility addition/upgrade costs (\$1,000's)

Reconductor to 795 kcm ACSS	120
Reconductor to 2 x 795 kcm ACSS	180
Reconductor to 477 kcm ACSS	110
Reconductor to 477 kcm ACSR	100
	115 kV
Rebuild to 795 kcm ACSS single ckt	350
Rebuild to 2 x 795 kcm ACSS single ckt	500

		qty	each	totals
Incremental Costs for this Option:	Lyon Co-Franklin 345 kV (2nd ckt)	44.0 mi	400	17,600
	Franklin-Helena 345 kV (2nd ckt)	67.0 mi	400	26,800
	Lyon Co: 345 kV line termination	1.0 ea	1,500	1,500
	Franklin: 345 kV line terminations	2.0 ea	1,500	3,000
	Helena: 345 kV line termination	1.0 ea	1,500	1,500
	Total			50,400

Losses equivalent capital value	Net Cost	MW Loss reduction w/r to base
	50,400	
-1,989	52,809	-2.0
7,351	43,997	7.3
8,232	43,680	8.2
32,325		32.1
	19,987	
34,565	18,179	34.3
34,742	18,003	34.5
35,270	21,429	35.0
37,058	22,341	36.8
37,914	25,109	37.7
39,273	23,750	39.0
40,733	22,290	40.5
40,758	27,410	40.5
41,111	27,057	40.8
43,074		42.8
	28,274	
44,484	26,864	44.2
48,059	24,969	47.7
47,933	25,095	47.6
48,663	27,365	48.3
49,343	26,685	49.0
51,760		51.4
	27,268	
54,902	25,644	54.5
56,019	27,911	55.6
59,282	24,648	58.9
59,312	34,374	58.9
60,823	34,863	60.4
61,427	34,259	61.0
61,669	34,017	61.2
61,820	36,830	61.4
64,448	34,202	64.0
65,838	35,896	65.4
67,439	34,495	67.0
70,399	31,535	69.9
70,430	38,504	69.9
71,004	44,950	70.5
72,997	46,677	72.5
74,448	50,494	73.9
75,747	49,595	75.2

78,012	47,330	77.5
78,043	58,300	77.5
79,885	57,692	79.3
82,060	55,517	81.5
84,538	53,039	84.0
85,958	51,819	85.4
86,894	51,653	86.3
88,616	49,931	88.0

Southwest Minnesota-->Twin Cities EHV Development

**Base Configuration--Big Stone at 230 kV
With 60% series compensation of Lyon Co-Franklin-Helena 345 kV**

Option 31A "incremental" improvements in service
Brookings Co-Lyon Co-Franklin-Helena-Lk Marion-Hampton Corner single circuit
with Lyon Co-Hazel 345 kV

Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

SW MN Buffalo Ridge Area Generation				Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	Installed Cost, \$1,000's	
Key	TLTG Limit MW	Base Case MW	System Limit MW							item	cumulative
								Add series comp			16,000
5	-1538	1200	-338	Lake Marion-Kenrick 115 @ 110% of 139	Airlake-Lk Marion 115	0.0230	Conductor	Reconductor	3.5 mi	420	16,420
	-1336	1200	-136	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0334	Conductor	Reconductor	4.4 mi	528	16,948
9	-1121	1200	79	Kenrick-Dakota Heights 115 @ 110% of 139	Airlake-Lk Marion 115	0.0230	Conductor	Reconductor	4.7 mi	564	17,512
2	-616	1200	584	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0184	Conductor	Rebuild	11.3 mi	3,955	21,467
3	-478	1200	722	Paynesville-Roscoe 69 @ 110% of 47	Paynesville-Wakefield 115	0.0174	Conductor	(Opt 31A facility)		0	21,467
4	-414	1200	786	Maynard-Kerkhoven Tp 115 @ 110% of 78	Granite Falls-Willmar 230	0.0215	Conductor	Rebuild	14.7 mi	5,145	26,612
	-400	1200	800	Morris 230/115 kV tx #2 @ 130% of 100	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0211	transformer	install larger tx	1 ea	400	27,012
7	-237	1200	963	Roscoe-Munson 69 @ 110% of 47	Paynesville-Wakefield 115	0.0174	Conductor	(Opt 31A facility)		0	27,012
	-130	1200	1070	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0242	Conductor	Reconductor	26.5 mi		3,180
14	-90	1200	1110	Minn Valley-Panther 230 @ 110% of 388	Lyon Co-Franklin 345	0.0887	Conductor	Reconductor	30.2 mi	3,624	30,192
8	-88	1200	1112 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0241				0	33,816
20	-37	1200	1163	Burnsville-Dakota Hgts @ 110% of 139	Airlake-Lk Marion 115	0.0230	Conductor	Reconductor	3.6 mi	432	34,248
10	-13	1200	1187	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0218	Transformer	Install 2nd tx	1 ea	3,000	37,248
			1200								37,248
11	19	1200	1219	Farm Tp-Munson Tp @ 110% of 47	Paynesville-Wakefield 115	0.0174	Conductor	(Opt 31A facility)		0	37,248
15	102	1200	1302	Helena-Blue Lk 345 @ 110% of 1165	Helena-Lk Marion 345	0.4080	Conductor	Reconductor	15.0 mi	2,700	39,948
13	358	1200	1549	Canby-Burr 115 @ 110% of 97	Brookings Co-Toronto 115	0.1076	Conductor	Rebuild	4.8 mi	1,680	41,628
			1600								41,628
18	549	1200	1749	St Cloud TpW-Wakefield 115 @ 110% of 113	Franklin-Helena 345	0.0511	Conductor	Reconductor	13.8 mi	1,518	43,146
22	578	1200	1778	McLeod-Panther 230 @ 110% of 388	Franklin-Helena 345	0.0884	Conductor	Reconductor	28.2 mi	3,384	46,530
	642	1200	1842	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0762	Transformer	Replace tx	1 ea		3,000
	674	1200	1874	Brookings Co 345/115 tx 1 or 2 @ 130% of 448	Brookings Co 345/115 tx #2 or 1	0.3189	Transformer	Install larger txs	2 ea	2,000	49,530
17	727	1200	1927	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Lyon Co-Franklin 345	0.3320	Conductor	Reconductor	54.2 mi	9,756	61,286
21	789	1200	1989	Henning-Fergus Fl 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0433	Term equip	Replace equip	2 ea	200	61,486
			2000								61,486
16	814	1200	2014	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	64,450
	814	1200	2014	Ft Ridgely-Franklin 115 @ 110% of 139	Franklin-Helena 345	0.0309	Conductor	Reconductor	25.7 mi	3,084	67,534
19	831	1200	2031 R	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Franklin-Helena 345	0.3278				0	67,534
	956	1200	2156	Winnebago-Winnebago S 161 @ 110% of 161	Prairie Island-Byron 345	0.0228	??			0	67,534
	1040	1200	2240	Loon Tp-Eastwood 115 @ 110% of 310	Lk Marion 345/115 tx	0.0388	Conductor	Add 2nd tx	1.0 ea	7,000	74,534
	1043	1200	2243	Sheyenne-Audubon 230 @ 110% of 320	Wahpeton-Fergus Falls 230	0.0336	Conductor	Reconductor	43.9 mi	5,268	79,802
1	1119	1200	2319	Granite Falls-Willmar 230 @ 110% of 388	Lyon Co-Franklin 345	0.0702	Conductor	Reconductor	31.0 ea	3,720	83,522
	1156	1200	2356	Minn Valley-Hazel 230 @ 110% of 388	Lyon Co-Franklin 345	0.1007	Conductor	Install larger wire	8.0 mi	400	83,922
			2529								83,922
	1330	1200	2530	Loon Tp-Eastwood 115 @ 110% of 310	Helena-Blue Lk 345	0.0476	Conductor	Rebuild to 600 MVA	22.0 mi	11,000	94,922
	1423	1200	2623	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0387	Term Equip	Replace equip	2.0 ea	200	95,122
	1442	1200	2642	Granite Falls-Minn Valley 230 @ 110% of 388	Hazel-Minn Valley 230	0.0550	Conductor	Reconductor	2.5 mi	300	95,422

24	1478	1200	2678	Wilmarth-Helena 345 @ 110% of 1165	Franklin-Helena 345	0.2876	Conductor	Reconductor	39.0 mi	7,020	102,442
	1407	1200	2765 R	Brookings Co 345/115 txs @ 100% of 448	(system intact)	0.1750	transformers			0	102,442
	1662	1200	2862	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0504	Conductor	Install larger wire	24.7 mi	1,235	103,677
	1700	1200	2900	(none)						0	103,677

Notes

1. TLTG analysis run on Summer 2011 off-peak powerflow case representing 1200 MW of "existing" Buffalo Ridge area gen.
Total SW MN Buffalo Ridge area gen = 1168 + 32 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV, 2nd Brookings Co 345/115 tx
Granite Falls-Willmar 230 kV uprated to 388 MVA (conductor thermal rating)
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 230 kV (345 kV const), Hazel-Granite Falls/Minn Valley 230 kV.
8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE
9/29/2005

Presumed facility addition/upgrade costs (\$1,000's)

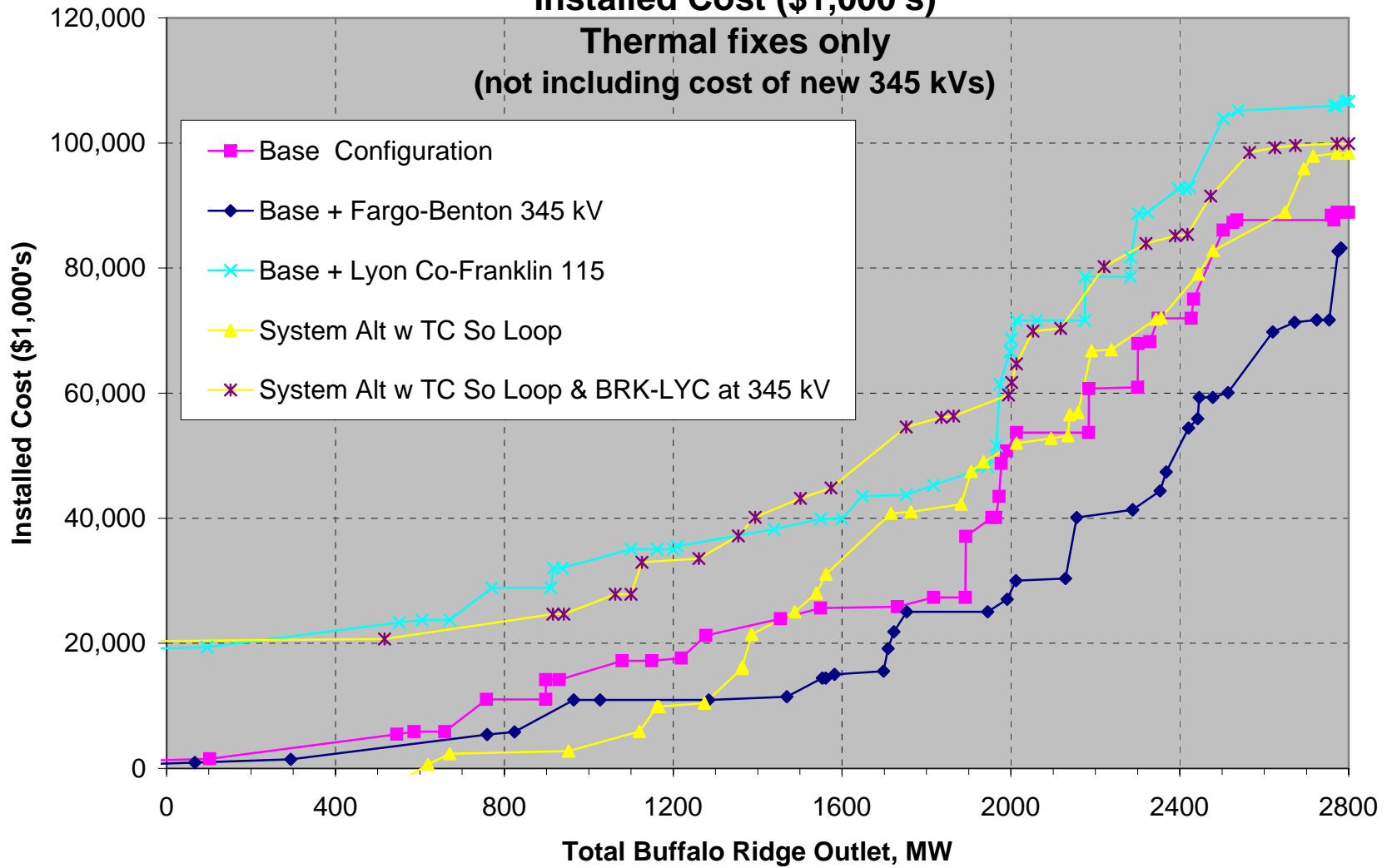
Reconductor to 795 kcm ACSS	120
Reconductor to 2 x 795 kcm ACSS	180
Reconductor to 477 kcm ACSS	110
Reconductor to 477 kcm ACSR	100
	115 kV
Rebuild to 795 kcm ACSS single ckt	350
Rebuild to 2 x 795 kcm ACSS single ckt	500

Base Costs for this Option:	Lyon Co-Franklin 345 kV series comp	<u>qty</u>	<u>each</u>	<u>totals</u>
	Franklin-Helena 345 kV series comp	1.0 ea	8,000	8,000
		1.0 ea	8,000	8,000
	Total			16,000

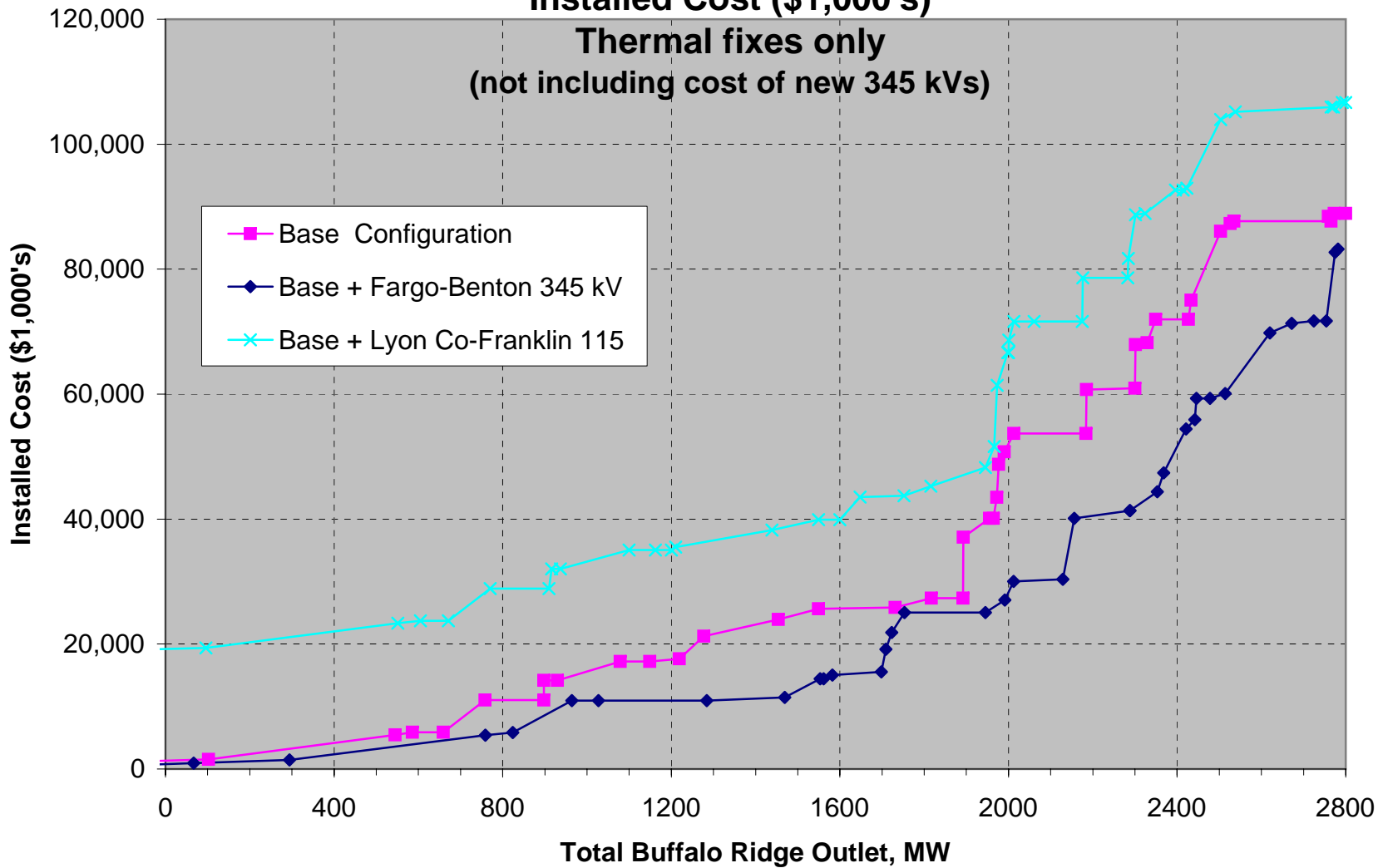
<u>Losses equivalent capital value</u>	<u>Net Cost</u>	<u>MW Loss reduction w/r to base</u>
1,787		1.8
4,330	12,618	4.3
7,036	10,476	7.0
13,393	8,074	13.3
15,130	6,337	15.0
15,936	10,676	15.8
16,112		16.0
	10,900	
18,164	8,848	18.0
19,511		19.4
	10,681	
20,014	13,802	19.9
20,039	13,777	19.9
20,681	13,567	20.5
20,983	16,265	20.8
21,147	16,101	21.0
21,386	15,862	21.2
22,431	17,517	22.3
25,540	16,088	25.4
26,182	15,446	26.0
29,183	13,963	29.0
29,767	16,763	29.6
31,056		30.8
	18,474	
31,700	19,830	31.5
32,768	28,518	32.5
34,016	27,470	33.8
34,238	27,248	34.0
34,520	29,930	34.3
34,520	33,014	34.3
34,862	32,672	34.6
37,380	30,154	37.1
39,072	35,462	38.8
39,132	40,670	38.9
40,663	42,859	40.4
41,408	42,514	41.1
44,892	39,030	44.6
44,912	50,010	44.6
46,785	48,337	46.5
47,168	48,254	46.8

47,893	54,549	47.6
49,645	52,797	49.3
51,599	52,078	51.2
52,364	51,313	52.0

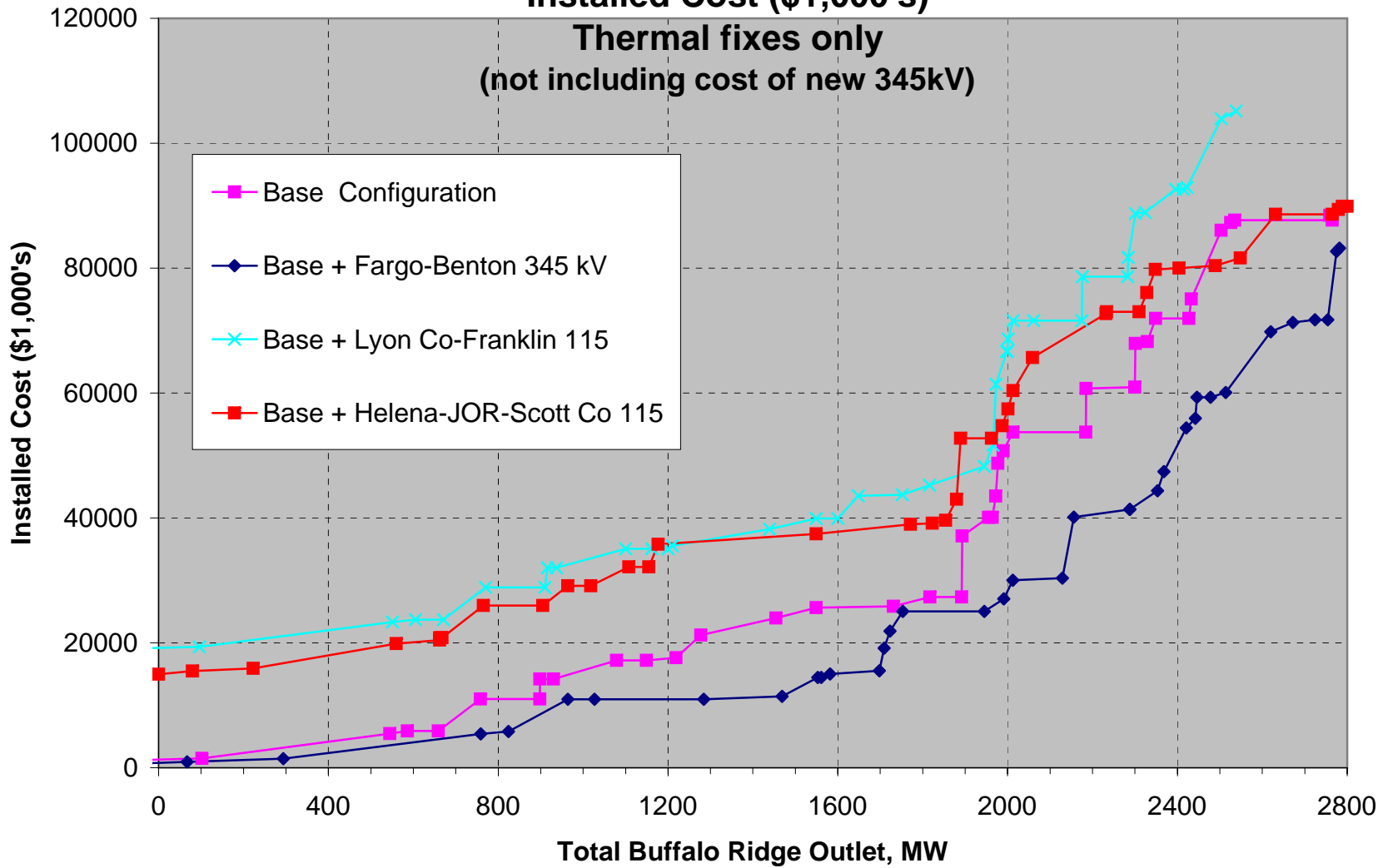
**SW Minnesota Generation Outlet
Installed Cost (\$1,000's)
Thermal fixes only
(not including cost of new 345 kV's)**



**SW Minnesota Generation Outlet
Installed Cost (\$1,000's)
Thermal fixes only
(not including cost of new 345 kVs)**



**SW Minnesota Generation Outlet
Installed Cost (\$1,000's)
Thermal fixes only
(not including cost of new 345kV)**



Southwest Minnesota-->Twin Cities EHV Development

"System Alternative" Configuration--Big Stone at 230 kV
 Option 31A "incremental" improvements in service
 Brookings Co-Lyon Co 115 kV & Lyon Co-Hazel-Blue Lk 345 kV

Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

		SW MN Buffalo Ridge Area Generation									
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	Installed Cost, \$1,000's item	\$1,000's cumulative
	-2425	1200	-1225	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0373	Conductor	Reconductor	4.4 mi	528	528
	-965	1200	235	Hyland Lk-Dean Lk @ 110% of 194	Blue Lk- Parkers Lk 345 & Blue Lk-Eden Pr 345 & Eden Pr 345/115 #9	0.0293	Conductor	Reconductor	3.2 mi	384	912
	-686	1200	514	Morris 230/115 kV tx #2 @ 130% of 100	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0227	transformer	install larger tx	1 ea	400	1,312
13	-187	1200	1013	Canby-Burr 115 @ 110% of 97	Canby-Big Stone 230	0.0278	Conductor	Rebuild	4.8 mi	1,680	2,992
#	-119	1200	1081	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0864	Transformer	Replace tx	1 ea	3,000	5,992
	-103	1200	1097	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0235	Conductor	Reconductor	26.5 mi	3,180	9,172
8	-61	1200	1139 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0225				0	9,172
	-2	1200	1198	Granite Falls-Morris 230 @ 110% of 239	Hazel-Canby 230	0.0191	Conductor	Reconductor	60.0 mi	7,200	16,372
	173	1200	1373	Winnebago-Winnebago S 161 @ 110% of 16	Prairie Island-Byron 345	0.0224	??			0	16,372
	333	1200	1533	Loon Tp-Eastwood 115 @ 100% of 310	Blue Lk-Inver Hills-Red Rock 345 & Blue Lk-Prairie Island 345	0.0430	Conductor	Rebuild to 600 MV	22.0 mi	11,000	27,372
	415	1200	1615	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0208	Transformer	Install 2nd tx	1 ea	3,000	30,372
	455	1200	1655	Blue Lk-Black Dog 115 @ 350 MVA emerg lin	Blue Lk-Hyland Lk 115 kV	0.0198	Conductor	Need BLL Outlet improvements			30,372
	554	1200	1754	Blair-Granite Falls 230 @ 110% of 398	Hazel-Canby 230	0.0578	Conductor	Reconductor	46.0 mi	5,520	35,892
	614	1200	1814	Blue Lk-Black Dog 115 @ 350 MVA emerg lin	Blue Lk-Parkers Lk 345 & Blue Lk-Eden Prairie 345 & Eden Pr 345/115 #9	0.0456		???			35,892
21	637	1200	1837	Henning-Fergus Fl 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0435	Term equip	Replace equip	2 ea	200	36,092
18	683	1200	1883	St Cloud TpW-Wakefield 115 @ 110% of 113	Hazel-Blue Lk 345	0.0497	Conductor	Reconductor	13.8 mi	1,518	37,610
16	812	1200	2012	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	40,574
	812	1200	2012	Sheyenne-Audubon 230 @ 110% of 320	Wahpeton-Fergus Falls 230	0.0363	Conductor	Reconductor	43.9 mi	5,268	45,842
	814	1200	2014	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0619	Conductor	Install larger wire	24.7 mi	1,235	47,077
14	834	1200	2034	Minn Valley-Panther 230 @ 110% of 388	Hazel-Blue Lk 345	0.0841	Conductor	Reconductor	30.2 mi	3,624	50,701
	838	1200	2038	Granite Falls-Minn Valley 230 @ 110% of 388	Hazel-Canby 230	0.0624	Conductor	Reconductor	2.5 mi	300	51,001
19	994	1200	2194	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Hazel-Blue Lk 345	0.3363				0	51,001
	1024	1200	2224	Johnson Jct-Morris 230 @ 110% of 390	Hazel-Canby 230	0.0619	Conductor	Install larger wire	15.4 mi	770	51,771
	1140	1200	2340	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0422	Term Equip	Replace equip	2.0 ea	200	51,971
	1248	1200	2448	Triboji-Spencer 161 @ 110% of 195	Wilmarth-Lakefield 345	0.0384	Conductor	Reconductor	4.0 mi	480	52,451
	1327	1200	2527	Big Stone-Ortonville 230 @ 110% of 390	Watertown-Granite Falls 230 & Blair-Granite Falls 230	0.0292	Conductor	Install larger wire	6.5 mi	325	52,776
	1327	1200	2527	Heron Lk-Brewster 161 @ 110% of 112	Nobles Co-Lakefield Jct 345	0.0293	Conductor	Rebuild	14.0 mi	4,900	57,676
	1346	1200	2546	Granite Falls-Willmar 230 @ 110% of 388	Hazel-Blue Lk 345	0.0688	Conductor	Reconductor	31.0 mi	3,720	61,396
	1427	1200	2627	Brookings Co 345/115 tx 1 or 2 @ 130% of 4	Brookings Co 345/115 tx 2 or 1	0.2542	Install larger txs		2.0 ea	2,000	63,396
22	1495	1200	2695	McLeod-Panther 230 @ 110% of 388	Hazel-Blue Lk 345	0.0847	Conductor	Reconductor	28.2 mi	3,384	66,780
	1574	1200	2774	Wilmarth-Dome 115 @ 110% of 310	Wilmarth-Eastwood 115	0.0350	Conductor	Rebuild to 600 MV	2.8 mi	1,400	68,180
	1587	1200	2787	Marshall SS-Marshall SE 115 @ 110% of 128	Erie Rd-Saratoga 115	0.0338	Conductor	Reconductor	1.7 mi	204	68,384
	1600	1200	2800	(none)							

Notes

1. TLTG analysis run on Summer 2011 off-peak powerflow case representing 1200 MW of "existing" Buffalo Ridge area gen.
Total SW MN Buffalo Ridge area gen = 1168 + 32 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV, 2nd Brookings Co 345/115 tx
Granite Falls-Willmar 230 kV uprated to 388 MVA (conductor thermal rating)
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 230 kV (345 kV const), Hazel-Granite Falls/Minn Valley 230 kV.
8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE

9/7/2005

Presumed facility addition/upgrade costs (\$1,000's)

Reconductor to 795 kcm ACSS				120
Reconductor to 2 x 795 kcm ACSS				180
Reconductor to 477 kcm ACSS				110
Reconductor to 477 kcm ACSR				100
	69 kV	115 kV	230 kV	
Rebuild to 795 kcm ACSS single ckt				350
Rebuild to 2 x 795 kcm ACSS single ckt				500

Grand Total	<u>qty</u>	<u>each</u>	<u>totals</u>
			#REF!

Southwest Minnesota-->Twin Cities EHV Development

"System Alternative" Configuration--Big Stone at 230 kV
 Option 31A "incremental" improvements in service
 Brookings Co-Lyon Co 115 kV & Lyon Co-Hazel-Blue Lk 345 kV
 (No Twin Cities "South 345 kV Loop")
 Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

SW MN Buffalo Ridge Area Generation											Installed Cost, \$1,000's	
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	item	cumulative	
	-2635	1200	-1435	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0373	Conductor	Reconductor	4.4 mi	528	528	
	-804	1200	396	Morris 230/115 kV tx #2 @ 130% of 100	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0227	transformer	install larger tx	1 ea	400	928	
#	-738	1200	462	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0305	Transformer	Replace tx	1 ea	3,000	3,928	
13	-502	1200	698	Canby-Burr 115 @ 110% of 97	Canby-Big Stone 230	0.0278	Conductor	Rebuild	4.8 mi	1,680	5,608	
	-454	1200	746	Granite Falls-Morris 230 @ 110% of 239	Hazel-Canby 230	0.0190	Conductor	Reconductor	60.0 mi	7,200	12,808	
#	-362	1200	838	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0864	Transformer	Replace tx	1 ea	3,000	15,808	
	-160	1200	1040	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0235	Conductor	Reconductor	26.5 mi	3,180	18,988	
8	-139	1200	1061	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0165	Conductor	Rebuild	11.3 mi	3,955	22,943	
	-120	1200	1080 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0225				0	22,943	
	85	1200	1285	Maynard-Kerhoven 115 @ 110% of 78	Granite Falls-Willmar 230	0.0192	Conductor	Rebuild	14.7 mi	5,145	28,088	
	188	1200	1388	Blair-Granite Falls 230 @ 110% of 398	Hazel-Canby 230	0.0578	Conductor	Reconductor	46.0 mi	5,520	33,608	
	193	1200	1393	Granite Falls-Minn Valley 230 @ 110% of 388	Hazel-Canby 230	0.0624	Conductor	Reconductor	2.5 mi	300	33,908	
	217	1200	1417	Loon Tp-Eastwood 115 @ 100% of 310	(system intact)	0.0400	Conductor	Rebuild to 600 MVA	22.0 mi	11,000	44,908	
14	225	1200	1425	Minn Valley-Panther 230 @ 110% of 388	Hazel-Blue Lk 345	0.0841	Conductor	Reconductor	30.2 mi	3,624	48,532	
	248	1200	1448	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0208	Transformer	Install 2nd tx	1 ea	3,000	51,532	
21	486	1200	1686	Henning-Fergus FI 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0433	Term equip	Replace equip	2 ea	200	51,732	
	628	1200	1828	Sheyenne-Audubon 230 @ 110% of 320	Wahpeton-Fergus Falls 230	0.0363	Conductor	Reconductor	43.9 mi	5,268	57,000	
19	643	1200	1843	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Hazel-Blue Lk 345	0.3363				0	57,000	
	667	1200	1867	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0619	Conductor	Install larger wire	24.7 mi	1,235	58,235	
18	688	1200	1888	St Cloud TpW-Wakefield 115 @ 110% of 113	Hazel-Blue Lk 345	0.0497	Conductor	Reconductor	13.8 mi	1,518	59,753	
16	813	1200	2013	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	62,717	
22	862	1200	2062	McLeod-Panther 230 @ 110% of 388	Hazel-Blue Lk 345	0.0847	Conductor	Reconductor	28.2 mi	3,384	66,101	
	879	1200	2079	Johnson Jct-Morris 230 @ 110% of 390	Hazel-Canby 230	0.0540	Conductor	Install larger wire	15.4 mi	770	66,871	
	921	1200	2121	Big Stone-Ortonville 230 @ 110% of 390	Watertown-Granite Falls 230 & Blair-Granite Falls 230	0.0292	Conductor	Install larger wire	6.5 mi	325	67,196	
	959	1200	2159	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0422	Term Equip	Replace equip	2.0 ea	200	67,396	
	1125	1200	2325	Heron Lk-Brewster 161 @ 110% of 112	Nobles Co-Lakefield Jct 345	0.0293	Conductor	Rebuild	14.0 mi	4,900	72,296	
	1158	1200	2358	Marshall SS-Marshall SE 115 @ 110% of 128	Erie Rd-Saratoga 115	0.0334	Conductor	Reconductor	1.7 mi	204	72,500	
	1213	1200	2413	Granite Falls-Willmar 230 @ 110% of 388	Hazel-Blue Lk 345	0.0688	Conductor	Reconductor	31.0 mi	3,720	76,220	
	1351	1200	2551	McLeod-Blue Lk 230 @ 110% of 388	Hazel-Blue Lk 345	0.0626	Conductor	Reconductor	51.0 mi	6,120	82,340	
	1364	1200	2564	Wilmarth-Dome 115 @ 110% of 310	Wilmarth-Eastwood 115	0.0350	Conductor	Rebuild to 600 MVA	2.8 mi	1,400	83,740	
	1432	1200	2632	Dome-Eastwood 115 @ 110% of 310	Wilmarth-Eastwood 115	0.0350	Conductor	Rebuild to 600 MVA	3.0 mi	1,500	85,240	
	1437	1200	2637	Winnebago-Winnebago S 161 @ 110% of 161	Loon Tp-Eastwood 115	0.0320	??			0	85,240	
	1438	1200	2638	Wilmarth-Blue Lk 345 @ 110% of 1165	Hazel-Blue Lk 345	0.2976	Conductor	Reconductor	54.8 mi	9,864	95,104	
	1455	1200	2655	Lakefield Jct 345/161 txs @ 130% of 335	Wilmarth-Lakefield Gen 345	0.0689	transformers	Replace txs	2.0 ea	7,000	102,104	
	1510	1200	2710	Brookings Co 345/115 tx 1 or 2 @ 130% of 448	Brookings Co 345/115 tx 2 or 1	0.2542		Install larger txs	2.0 ea	2,000	104,104	
	1573	1200	2773	Triboji-Spencer 161 @ 110% of 195	Wilmarth-Lakefield 345	0.0384	Conductor	Reconductor	4.0 mi	480	104,584	
	1600	1200	2800	(none)						0	104,584	

Southwest Minnesota-->Twin Cities EHV Development

Base Configuration--Big Stone at 230 kV

Option 31A "incremental" improvements in service

Brookings Co-Lyon Co-Franklin-Helena-Lk Marion-Hampton Corner single circuit

with Lyon Co-Lk Yankton & Lyon Co-Hazel 345 kV

Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

With Fargo-Benton Co 345 kV

SW MN Buffalo Ridge Area Generation										Installed Cost, \$1,000's	
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	item	cumulative
5	-1350	1200	-150	Lake Marion-Kenrick 115 @ 110% of 139	Airlake-Lk Marion 115	0.0212	Conductor	Reconductor	3.5 mi	420	420
	-1133	1200	67	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0326	Conductor	Reconductor	4.4 mi	528	948
9	-906	1200	294	Kenrick-Dakota Heights 115 @ 110% of 139	Airlake-Lk Marion 115	0.0212	Conductor	Reconductor	4.3 mi	516	1,464
2	-441	1200	759	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0187	Conductor	Rebuild	11.3 mi	3955	5,419
	-376	1200	824	Morris 230/115 kV tx #2	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0267	Transformer	install larger tx	1.0 ea	400	5,819
4	-236	1200	964	Maynard-Kerkhoven Tp 115 @ 110% of 78	Granite Falls-Willmar 230	0.0218	Conductor	Rebuild	14.7 mi	5145	10,964
3	-173	1200	1027	Paynesville-Roscoe 69 @ 110% of 47	Paynesville-Wakefield 115	0.0158	Conductor	(Opt 31A facility)	0.0	0	10,964
7	84	1200	1284	Roscoe-Munson 69 @ 110% of 47	Paynesville-Wakefield 115	0.0158	Conductor	(Opt 31A facility)	0.0	0	10,964
20	269	1200	1469	Burnsville- Dakota Hgts @ 110% of 139	Airlake-Lk Marion 115	0.0212	Conductor	Reconductor	4.0 mi	480	11,444
10	353	1200	1553	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0205	Transformer	Install 2nd tx	1.0 ea	3,000	14,444
11	361	1200	1561	Farm Tp-Munson Tp @ 110% of 47	Paynesville-Wakefield 115	0.0158	Conductor	(Opt 31A facility)	0.0	0	14,444
13	382	1200	1582	Canby-Burr 115 @ 110% of 97	Brookings Co-Toronto 115	0.1070	Conductor	Rebuild	4.8 mi	576	15,020
	498	1200	1698	Sheyenne-Fargo 230 @ 110% of 387	Hankson-Wahpeton 230	0.0586	Conductor	Reconductor	4.3 mi	516	15,536
14	509	1200	1709	Minn Valley-Panther 230 @ 110% of 388	Lyon Co-Franklin 345	0.0791	Conductor	Reconductor	30.2 mi	3624	19,160
15	523	1200	1723	Helena-Blue Lk 345 @ 110% of 1165	Helena-Lk Marion 345	0.3680	Conductor	Reconductor	15.0 mi	2,700	21,860
6	553	1200	1753	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0301	Conductor	Reconductor	26.5 mi		25,040
8	745	1200	1945 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0282			0.0	3180	25,040
	791	1200	1991	Brookings Co 345/115 tx 1 or 2 @ 130% of 4	Brookings Co 345/115 tx #2 or 1	0.3091	Transformer	Install larger txs	2 ea	2,000	27,040
16	812	1200	2012	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2964	30,004
	929	1200	2129	Grant Co-Elbow Lk 115 @ 110% of 160	Maple River-Alex SS 345	0.0287	Clearance	upgrade structures	3.6 mi	360	30,364
17	956	1200	2156	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Lyon Co-Franklin 345	0.3190	Conductor	Reconductor	54.2 mi	9,756	40,120
	1088	1200	2288	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0573	Conductor	Install larger wire	24.7 mi	1,235	41,355
	1088	1200	2288	Winnebago-Winnebago S 161 @ 110% of 16	Prairie Island-Byron 345	0.0225	??				41,355
	1153	1200	2353	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0681	transformer	Replace tx	1.0 ea		44,355
	1168	1200	2368	Hankson-Wahpeton 230 @ 110% of 320	Ortonville-Johnson Jct 230	0.0565	Conductor	Reconductor	25.5 mi	3060	47,415
	1221	1200	2421	Loon Tp-Eastwood 115 @ 110% of 310	Lk Marion 345/115 tx	0.0375	Conductor	Add 2nd tx	1.0 ea	7,000	54,415
18	1242	1200	2442	St Cloud TpW-Wakefield 115 @ 110% of 113	Franklin-Helena 345	0.0440	Conductor	Reconductor	13.8 mi	1518	55,933
22	1246	1200	2446	McLeod-Panther 230 @ 110% of 388	Franklin-Helena 345	0.0787	Conductor	Reconductor	28.2 mi	3,384	59,317
	1278	1200	2478	Elbow Lk-Brandon 115 @ 110% of 160	Maple River-Alex SS 345	0.0287	Clearance	upgrade structures		0	59,317
	1314	1200	2514	Johnson Jct-Morris 230 @ 110% of 390	Hazel-Canby 230	0.0573	Conductor	Install larger wire	15.4 mi	770	60,087
24	1420	1200	2620	Wilmarth-Helena 345 @ 110% of 1165	Franklin-Helena 345	0.2967	Conductor	Reconductor	54.0 mi	9,720	69,807
	1472	1200	2672	Morris 230/115 tx #1 @ 130% of 100	Morris 230/115 tx # 2	0.0217	Transformer	Replace tx	1.0 ea	1,500	71,307
	1524	1200	2724	Minn Valley-Hazel 230 @ 110% of 388	Lyon Co-Franklin 345	0.0934	Conductor	Install larger wire	8.0 mi	400	71,707
	1554	1200	2754 R	Brookings Co 345/115 txs @ 100% of 448	(system intact)	0.1690	transformers			0	71,707
	1575	1200	2775	Loon Tp-Eastwood 115 @ 110% of 310	Helena-Blue Lk 345	0.0430	Conductor	Rebuild to 600 MV	22.0 mi	11,000	82,707
	1582	1200	2782	Triboji-Spencer 161 @ 110% of 195	Wilmarth-Lakefield Gen 345	0.0454	Conductor	Reconductor	4.0 mi	480	83,187
	1600	1200	2800	(none)							

Notes

1. TLTG analysis run on Summer 2011 off-peak powerflow case representing 1200 MW of "existing" Buffalo Ridge area gen.

- Total SW MN Buffalo Ridge area gen = 1160 + 40 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
 3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV
 4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
 6. Big Stone 2 = 600 MW net
 7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 230 kV, Hazel-Granite Falls/Minn Valley 230 kV.
 8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE

8/15/2005

Presumed facility addition/upgrade costs (\$1,000's)

Reconductor to 795 kcm ACSS				120
Reconductor to 2 x 795 kcm ACSS				180
Reconductor to 477 kcm ACSS				110
Reconductor to 477 kcm ACSR				100
	69 kV	115 kV	230 kV	
Rebuild to 795 kcm ACSS single ckt				350
Rebuild to 2 x 795 kcm ACSS single ckt				500

3

XXXX

Southwest Minnesota-->Twin Cities EHV Development

Base Configuration--Big Stone at 230 kV

Option 31A "incremental" improvements in service

Brookings Co-Lyon Co-Franklin-Helena-Lk Marion-Hampton Corner single circuit
with Lyon Co-Hazel 345 kV

Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

With Lyon Co-Franklin 115 kV

SW MN Buffalo Ridge Area Generation						distribution	Limiting	Remedy	qty	Installed	Cost, \$,1,000's
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	factor	factor			item	cumulative c
								Lyon Co-Franklin 115 kV		17,900	17,900
5	-1532	1200	-332	Lake Marion-Kenrick 115 @ 110% of 139	Airlake-Lk Marion 115	0.0224	Conductor	Reconductor	3.5 mi	420	18,320
	-1398	1200	-198	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0339	Conductor	Reconductor	4.4 mi	528	18,848
9	-1104	1200	96	Kenrick-Dakota Heights 115 @ 110% of 139	Airlake-Lk Marion 115	0.0224	Conductor	Reconductor	4.3 mi	516	19,364
2	-649	1200	551	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0188	Conductor	Rebuild	11.3 mi	3,955	23,319
	-595	1200	605	Morris 230/115 kV tx #2	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0221	Transformer	install larger tx	1.0 ea	400	
3	-529	1200	671	Paynesville-Roscoe 69 @ 110% of 47	Paynesville-Wakefield 115	0.0179	Conductor	(Opt 31A facility)		0	23,719
4	-430	1200	770	Maynard-Kerkhoven Tp 115 @ 110% of 78	Granite Falls-Willmar 230	0.0217	Conductor	Rebuild	14.7 mi	5,145	28,864
7	-290	1200	910	Roscoe-Munson 69 @ 110% of 47	Paynesville-Wakefield 115	0.0179	Conductor	(Opt 31A facility)		0	28,864
6	-284	1200	916	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0249	Conductor	Reconductor	26.5 mi		3,180
8	-263	1200	937 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0240				0	32,044
10	-100	1200	1100	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0225	Transformer	Install 2nd tx	1.0 ea	3,000	35,044
11	-38	1200	1162	Farm Tp-Munson Tp @ 110% of 47	Paynesville-Wakefield 115	0.0179	Conductor	(Opt 31A facility)		0	35,044
20	10	1200	1210	Burnsville- Dakota Hgts @ 110% of 139	Airlake-Lk Marion 115	0.0224	Conductor	Reconductor	4.0 mi	480	35,524
15	239	1200	1439	Helena-Blue Lk 345 @ 110% of 1165	Helena-Lk Marion 345	0.3903	Conductor	Reconductor	15.0 mi	2,700	38,224
13	349	1200	1549	Canby-Burr 115 @ 110% of 97	Brookings Co-Toronto 115	0.1078	Conductor	Rebuild	4.8 mi	1,680	39,904
14	448	1200	1648	Minn Valley-Panther 230 @ 110% of 388	Lyon Co-Franklin 345	0.0808	Conductor	Reconductor	30.2 mi	3,624	43,528
21	552	1200	1752	Henning-Fergus Fl 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0431	Term equip	Replace equip	2.0 ea	200	43,728
18	616	1200	1816	St Cloud TpW-Wakefield 115 @ 110% of 113	Franklin-Helena 345	0.0505	Conductor	Reconductor	13.8 mi	1,518	45,246
	745	1200	1945	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0742	Transformer	Replace tx	1.0 ea		3,000
22	766	1200	1966	McLeod-Panther 230 @ 110% of 388	Franklin-Helena 345	0.0870	Conductor	Reconductor	28.2 mi	3,384	51,630
17	773	1200	1973	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Franklin-Helena 345	0.3307	Conductor	Reconductor	54.2 mi	9,756	61,386
	798	1200	1998	Sheyenne-Audubon 230 @ 110% of 320	Wahpeton-Fergus Falls 230	0.0354	Conductor	Reconductor	43.9 mi	5,268	66,654
			2000								66,654
	801	1200	2001	Brookings Co 345/115 tx 1 or 2 @ 130% of 448	Brookings Co 345/115 tx #2 or 1	0.3096	Transformer	Install larger txs	2 ea	2,000	68,654
16	813	1200	2013	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	71,618
17	861	1200	2061 R	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Lyon Co-Franklin 345	0.3216	Conductor			0	71,618
			2175								71,618
	976	1200	2176	Loon Tp-Eastwood 115 @ 110% of 310	Lk Marion 345/115 tx	0.0391	Conductor	Add 2nd tx	1.0 ea	7,000	78,618
			2283							0	78,618
	1084	1200	2284	Ft Ridgely-Franklin 115 @ 110% of 139	Franklin-Helena 345	0.0290	Conductor	Reconductor	25.7 mi	3,084	81,702
24	1101	1200	2301	Wilmarth-Helena 345 @ 110% of 1165	Franklin-Helena 345	0.3131	Conductor	Reconductor	39.0 mi	7,020	88,722
	1124	1200	2324	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0409	Term Equip	Replace equip	2.0 ea	200	88,922
1	1196	1200	2396	Granite Falls-Willmar 230 @ 110% of 388	Minn Valley-Panther 230	0.0661	Conductor	Reconductor	31.0 mi	3,720	92,642
	1214	1200	2414	Winnebago-Winnebago S 161 @ 110% of 161	Prairie Island-Byron 345	0.0224	??			0	92,642
	1223	1200	2423	Granite Falls-Minn Valley 230 @ 110% of 388	Hazel-Minn Valley 230	0.0599	Conductor	Reconductor	2.5 mi	300	92,942
	1294	1200	2503	Loon Tp-Eastwood 115 @ 110% of 310	Helena-Blue Lk 345	0.0477	Conductor	Rebuild to 600 MV,	22.0 mi	11,000	103,942

1338	1200	2538	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0538	Conductor	Install larger wire	24.7 mi	1,235	105,177
1571	1200	2771	Johnson Jct-Morris 230 @ 110% of 390	Hazel-Canby 230	0.0538	Conductor	Install larger wire	15.4 mi	770	105,947
1565	1200	2765 R	Brookings Co 345/115 txs @ 100% of 448	(system intact)	0.1690	transformers			0	105,947
1592	1200	2792	Triboji-Spencer 161 @ 110% of 195	Wilmarth-Lakefield 345	0.0371	Conductor	Reconductor	4.0 mi	720	106,667
1600	1200	2800	(none)						0	106,667

Notes

1. TLTG analysis run on Summer 2011 off-peak powerflow case representing 1200 MW of "existing" Buffalo Ridge area gen.
Total SW MN Buffalo Ridge area gen = 1160 + 40 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV, 2nd Brookings Co 345/115 tx, new Lyon Co-Franklin 115 kV (
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 230 kV, Hazel-Granite Falls/Minn Valley 230 kV.
8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE

9/7/2005

Presumed facility addition/upgrade costs (\$1,000's)

Reconductor to 795 kcm ACSS	120
Reconductor to 2 x 795 kcm ACSS	180
Reconductor to 477 kcm ACSS	110
Reconductor to 477 kcm ACSR	100
	69 kV 115 kV 230 kV
Rebuild to 795 kcm ACSS single ckt	350
Rebuild to 2 x 795 kcm ACSS single ckt	500
Rebuild to 795/477 kcm ACSS double ckt 115/69 kV	500

Basic Option cost

Build 44 mi; assume 1/2 of mileage is single ckt 115 kV, 1/2 is 115/69 kV double ckt, 795 ACSS (310 MVA)/477 kcm ACSS line terms at Lyon Co and Franklin @ \$1,000 each	18,700
	<u>2,000</u>
	20,700
Less: 8 mi between Milroy & Sheridan already built for load serving purposes	<u>2,800</u>
	17,900

Losses equivalent capital value	Net Cost	MW Loss reduction w/r to base
-251	18,571	-0.2
-150	18,998	-0.1
73	19,291	0.1
416	22,903	0.4
457		0.5
	23,262	
507	23,212	0.5
582	28,282	0.6
687	28,177	0.7
692		0.7
	31,352	
708	31,336	0.7
831	34,213	0.8
878	34,166	0.9
906	34,138	0.9
914	34,610	0.9
1,087	37,137	1.1
1,170	38,734	1.2
1,208	38,696	1.2
1,160	42,368	1.2
1,055	42,673	1.0
991	44,255	1.0
861		0.9
	47,385	
840	50,790	0.8
833	60,553	0.8
808	65,846	0.8
806	65,848	0.8
805	67,849	0.8
793	70,825	0.8
744	70,874	0.7
629	70,989	0.6
628	77,990	0.6
521	78,097	0.5
520	81,182	0.5
502	88,220	0.5
479	88,443	0.5
407	92,235	0.4
389	92,253	0.4
380	92,562	0.4
299	103,643	0.3

264	104,913	0.3
29	105,918	0.0
35	105,912	0.0
8	106,659	0.0
0	106,667	0.0

(795 kcm ACSS)

Southwest Minnesota-->Twin Cities EHV Development

Base Configuration--Big Stone at 230 kV

Option 31A "incremental" improvements in service

Brookings Co-Lyon Co-Franklin-Helena-Lk Marion-Hampton Corner single circuit
with Lyon Co-Hazel 345 kV

Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

SW MN Buffalo Ridge Area Generation									Installed Cost, \$1,000's		
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	item	cumulative
5	-1527	1200	-327	Lake Marion-Kenrick 115 @ 110% of 139	Airlake-Lk Marion 115	0.0223	Conductor	Reconductor	3.5 mi	420	420
	-1395	1200	-195	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0339	Conductor	Reconductor	4.4 mi	528	948
9	-1098	1200	102	Kenrick-Dakota Heights 115 @ 110% of 139	Airlake-Lk Marion 115	0.0232	Conductor	Reconductor	4.7 mi	564	1,512
2	-655	1200	545	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0188	Conductor	Rebuild	11.3 mi	3,955	5,467
	-614	1200	586	Morris 230/115 kV tx #2 @ 130% of 100	Granite Falls-Morris-Moorhead 230 & Morris 230/115 tx #1	0.0223	transformer	install larger tx	1 ea	400	5,867
3	-541	1200	659	Paynesville-Roscoe 69 @ 110% of 47	Paynesville-Wakefield 115	0.0180	Conductor	(Opt 31A facility)		0	5,867
4	-442	1200	758	Maynard-Kerkhoven Tp 115 @ 110% of 78	Granite Falls-Willmar 230	0.0218	Conductor	Rebuild	14.7 mi	5,145	11,012
7	-302	1200	898	Roscoe-Munson 69 @ 110% of 47	Paynesville-Wakefield 115	0.0180	Conductor	(Opt 31A facility)		0	11,012
	-302	1200	898	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230 & Maple River-Wahpeton 230 & Wahpeton 230/115 tx	0.0250	Conductor	Reconductor	26.5 mi		3,180
8	-270	1200	930 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0241				0	14,192
10	-121	1200	1079	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0227	Transformer	Install 2nd tx	1 ea	3,000	17,192
11	-51	1200	1149	Farm Tp-Munson Tp @ 110% of 47	Paynesville-Wakefield 115	0.0180	Conductor	(Opt 31A facility)		0	17,192
20	19	1200	1219	Burnsville-Dakota Hgts @ 110% of 139	Airlake-Lk Marion 115	0.0223	Conductor	Reconductor	3.6 mi	432	17,624
14	77	1200	1277	Minn Valley-Panther 230 @ 110% of 388	Lyon Co-Franklin 345	0.0873	Conductor	Reconductor	30.2 mi	3,624	21,248
15	254	1200	1454	Helena-Blue Lk 345 @ 110% of 1165	Helena-Lk Marion 345	0.3888	Conductor	Reconductor	15.0 mi	2,700	23,948
13	349	1200	1549	Canby-Burr 115 @ 110% of 97	Brookings Co-Toronto 115	0.1078	Conductor	Rebuild	4.8 mi	1,680	25,628
21	531	1200	1731	Henning-Fergus Fl 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0433	Term equip	Replace equip	2 ea	200	25,828
18	617	1200	1817	St Cloud TpW-Wakefield 115 @ 110% of 113	Franklin-Helena 345	0.0505	Conductor	Reconductor	13.8 mi	1,518	27,346
			1892								27,346
17	693	1200	1893	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Lyon Co-Franklin 345	0.3338	Conductor	Reconductor	54.2 mi	9,756	37,102
	755	1200	1955	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0740	Transformer	Replace tx	1 ea		3,000
19	764	1200	1964 R	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Franklin-Helena 345	0.3314				0	40,102
22	772	1200	1972	McLeod-Panther 230 @ 110% of 388	Franklin-Helena 345	0.0870	Conductor	Reconductor	28.2 mi	3,384	43,486
	777	1200	1977	Sheyenne-Audubon 230 @ 110% of 320	Wahpeton-Fergus Falls 230	0.0356	Conductor	Reconductor	43.9 mi	5,268	48,754
	790	1200	1990	Brookings Co 345/115 tx 1 or 2 @ 130% of 44	Brookings Co 345/115 tx #2 or 1	0.3096	Transformer	Install larger txs	2 ea	2,000	50,754
16	813	1200	2013	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	53,718
			2184								53,718
	985	1200	2185	Loon Tp-Eastwood 115 @ 110% of 310	Lk Marion 345/115 tx	0.0390	Conductor	Add 2nd tx	1.0 ea	7,000	60,718
	1100	1200	2300	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0411	Term Equip	Replace equip	2.0 ea	200	60,918
24	1101	1200	2301	Wilmarth-Helena 345 @ 110% of 1165	Franklin-Helena 345	0.3131	Conductor	Reconductor	39.0 mi	7,020	67,938
	1129	1200	2329	Granite Falls-Minn Valley 230 @ 110% of 388	Hazel-Minn Valley 230	0.0611	Conductor	Reconductor	2.5 mi	300	68,238
1	1149	1200	2349	Granite Falls-Willmar 230 @ 110% of 388	Minn Valley-Panther 230	0.0668	Conductor	Reconductor	31.0 ea	3,720	71,958
	1227	1200	2427	Winnebago-Winnebago S 161 @ 110% of 161	Prairie Island-Byron 345	0.0224	??			0	71,958
	1233	1200	2433	Ft Ridgely-Franklin 115 @ 110% of 139	Franklin-Helena 345	0.0280	Conductor	Reconductor	25.7 mi	3,084	75,042
	1303	1200	2503	Loon Tp-Eastwood 115 @ 110% of 310	Helena-Blue Lk 345	0.0476	Conductor	Rebuild to 600 MVA	22.0 mi	11,000	86,042
	1326	1200	2526	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0540	Conductor	Install larger wire	24.7 mi	1,235	87,277
	1335	1200	2535	Minn Valley-Hazel 230 @ 110% of 388	Lyon Co-Franklin 345	0.0962	Conductor	Install larger wire	8.0 mi	400	87,677
	1551	1200	2765 R	Brookings Co 345/115 txs @ 100% of 448	(system intact)	0.1700	transformers			0	87,677
	1559	1200	2759	Johnson Jct-Morris 230 @ 110% of 390	Hazel-Canby 230	0.0540	Conductor	Install larger wire	15.4 mi	770	88,447

1573	1200	2773	Triboji-Spencer 161 @ 110% of 195	Wilmarth-Lakefield 345	0.0372	Conductor	Reconductor	4.0 mi	480	88,927
1600	1200	2800	(none)						0	88,927

Notes

1. TLTG analysis run on Summer 2011 off-peak powerflow case representing 1200 MW of "existing" Buffalo Ridge area gen.
Total SW MN Buffalo Ridge area gen = 1168 + 32 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV, 2nd Brookings Co 345/115 tx
Granite Falls-Willmar 230 kV uprated to 388 MVA (conductor thermal rating)
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 230 kV (345 kV const), Hazel-Granite Falls/Minn Valley 230 kV.
8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE
9/7/2005

Presumed facility addition/upgrade costs (\$1,000's)

Reconductor to 795 kcm ACSS	120
Reconductor to 2 x 795 kcm ACSS	180
Reconductor to 477 kcm ACSS	110
Reconductor to 477 kcm ACSR	100
	115 kV
Rebuild to 795 kcm ACSS single ckt	350
Rebuild to 2 x 795 kcm ACSS single ckt	500

Base Costs for this Option:	qty	each	totals
Brookings Co-Lyon Co 345 kV	49.0 mi	800	39,200
Lyon Co-Franklin 345 kV	44.0 mi	800	35,200
Franklin-Helena 345 kV	67.0 mi	800	53,600
Helena-Lk Marion-Hampton Corner 345 kV	34.0 mi	800	27,200
Lyon Co-Hazel 345 kV	22.0 mi	800	17,600
Lyon Co-Hazel: remove existing 115 kV	22.0 mi	40	880
Yankee-Brookings Co 115 kV #2 (620 MVA)	14.0 mi	500	7,000
Brookings Co-Toronto 115 kV (310 MVA)	20.0 mi	350	7,000
Hazel-Minn Valley 230 kV	8.0 mi	450	3,600
Minn Valley 230 kV line re-arrangements	1.0 ea	2,000	2,000
Blue Lk-Wilmarth in-and out to Helena Sw Stn	1.0 ea	2,000	2,000
	Subtotal (lines)		195,280
Brookings Co: add 345 kV line term (Lyon Co)	1.0 ea	1,500	1,500
Brookings Co: add 2nd 345/115 kV 448 MVA tx	1.0 ea	6,000	6,000
Brookings Co: add 115 kV line term (for YKE)	1.0 ea	1,000	1,000
Brookings Co: add 115 kV line term (for Toronto)	1.0 ea	1,000	1,000
Brookings Co: add 50 MVAR shunt reactor	1.0 ea	1,200	1,200
Brookings Co: add 2 x 40 MVAR shunt caps	2.0 ea	750	1,500
Lyon Co: Add 4-position 345 kV ring bus	1.0 ea	6,000	6,000
Lyon Co: Add 345/115 kV 448 MVA tx	1.0 ea	6,000	6,000
Lyon Co: add 50 MVAR shunt reactor	1.0 ea	1,200	1,200

Southwest Minnesota-->Twin Cities EHV Development

Base Configuration--Big Stone at 345 kV

Option 31A "incremental" improvements in service

Brookings Co-Lyon Co-Franklin-Helena-Lk Marion-Hampton Corner single circuit
with Lyon Co-Lk Yankton & Lyon Co-Hazel 345 kV
Big Stone-Canby-Hazel @ 345 kV, 2 x 795 ACSR

SW MN Buffalo Ridge Area Generation									Installed Cost, \$1,000's		
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	item	cumulative
	-6373	1200	-5173	Canby-Burr 115 @ 110% of 97	Hazel-Canby 345	0.0517	Conductor	Reconductor	4.8 mi	576	576
5	-1539	1200	-339	Lake Marion-Kerrick 115 @ 110% of 139	Airlake-Lk Marion 115	0.0226	Conductor	Reconductor	3.5 mi	420	996
1	-1648	1200	-448	Granite Falls-Willmar 230 @ 110% of 288	Sherco #3 gen	0.0276	terminal equip	Reconductor	31.0 mi	3,720	4,716
	-1391	1200	-191	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0341	Conductor	Reconductor	4.4 mi	528	5,244
	-1215	1200	-15	Dawson Jct-Canby 115 @ 110% of 94	Hazel-Canby 345	0.0483		Reconductor	21.2 mi	2,544	7,788
	-1201	1200	-1	So. Jct-Louisburg Jct 115 @ 110% of 94	Hazel-Canby 345	0.0483		Reconductor	3.5 mi	420	8,208
	-1198	1200	2	So. Jct-Appleton 115 @ 110% of 94	Hazel-Canby 345	0.0483		Reconductor	3.4 mi	408	8,616
9	-1115	1200	85	Kerrick-Dakota Heights 115 @ 110% of 139	Airlake-Lk Marion 115	0.0226	Conductor	Reconductor	4.7 mi	564	9,180
	-1040	1200	160	Appleton-Correll 115 @ 110% of 97	Hazel-Canby 345	0.0483		Reconductor	6.1 mi	732	9,912
	-1033	1200	167	Marsh Lk-Correll 115 @ 110% of 97	Hazel-Canby 345	0.0483		Reconductor	2.0 mi	240	10,152
	-986	1200	214	Marsh Lk-Odessa 115 @ 110% of 97	Hazel-Canby 345	0.0483		Reconductor	6.7 mi	804	10,956
	-975	1200	225	OrtonvQuar-Odessa 115 @ 110% of 97	Hazel-Canby 345	0.0483		Reconductor	4.6 mi	552	11,508
	-961	1200	239	Ortonville-OrtonvQuar 115 @ 110% of 97	Hazel-Canby 345	0.0483		Reconductor	3.3 mi	396	11,904
2	-721	1200	479	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0185	Conductor	Rebuild	11.3 mi	3,955	15,859
	-692	1200	508	Burr-Marietta 115 @ 110% of 96	Hazel-Canby 345	0.0525		Reconductor	21.5 mi	2,580	18,439
	-661	1200	539	Marietta-Big Stone 115 @ 110% of 96	Hazel-Canby 345	0.0525		Reconductor	24.1 mi	2,892	21,331
4	-537	1200	663	Maynard-Kerkhoven Tp 115 @ 110% of 78	Granite Falls-Willmar 230	0.0216	Conductor	Rebuild	14.7 mi	5,145	26,476
3	-468	1200	732	Paynesville-Roscoe 69 @ 110% of 47	Paynesville-Wakefield 115	0.0176	Conductor	(Opt 31A facility)		0	26,476
7	-229	1200	971	Roscoe-Munson 69 @ 110% of 47	Paynesville-Wakefield 115	0.0176	Conductor	(Opt 31A facility)		0	26,476
20	-11	1200	1189	Burnsville- Dakota Hgts @ 110% of 139	Airlake-Lk Marion 115	0.0226	Conductor	Reconductor	3.6 mi	432	26,908
10	-3	1200	1197	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0221	Transformer	Install 2nd tx	1.0 ea	3,000	29,908
14	2	1200	1202	Minn Valley-Panther 230 @ 110% of 388	Lyon Co-Franklin 345	0.0859	Conductor	Reconductor	30.2 mi	3,624	33,532
11	25	1200	1225	Farm Tp-Munson Tp @ 110% of 47	Paynesville-Wakefield 115	0.0176	Conductor	(Opt 31A facility)		0	33,532
6	49	1200	1249	Grant Co-Morris 115 @ 110% of 96	Maple River-Fergus Fls 230 &	0.0242	Conductor	Reconductor	26.5 mi	3,180	36,712
8	72	1200	1272 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0232				0	36,712
23	95	1200	1295	Brookings Co-Toronto 115 @ 110% of 310	Hazel-Canby 230	0.1492	Conductor	Add 2nd BRK-Toronto 115		9,000	45,712
	184	1200	1384	Morris 230/115 tx @ 2 @ 130% of 100	Granite Falls-Morris 230 & Morris-Moorhead 230 & Morris 230/115 tx # 1	0.0208	transformer	install larger tx	1.0 ea	400	46,112
15	192	1200	1392	Helena-Blue Lk 345 @ 110% of 1165	Helena-Lk Marion 345	0.3937	Conductor	Reconductor	15.0 mi	2,700	48,812
	625	1200	1825	Brookings Co 345/115 tx 1 or 2 @ 130% of 44	Brookings Co 345/115 tx # 2 or 1	0.3177		Install larger txs	2.0 ea	2,000	50,812
17	657	1200	1857	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Lyon Co-Franklin 345	0.3371	Conductor	Reconductor	54.2 mi	9,756	60,568
	698	1200	1898	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0748	transformer	Replace tx	1.0 ea	3,000	63,568
22	698	1200	1898	McLeod-Panther 230 @ 110% of 388	Franklin-Helena 345	0.0858	Conductor	Reconductor	28.2 mi	3,384	66,952
19	748	1200	1948 R	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Franklin-Helena 345	0.3831	Conductor			0	66,952
18	807	1200	2007	St Cloud TpW-Wakefield 115 @ 110% of 113	Franklin-Helena 345	0.0475	Conductor	Reconductor	13.8 mi	1,518	68,470
16	832	1200	2032	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.1500	Conductor	Reconductor	24.7 mi	2,964	71,434
21	865	1200	2065	Henning-Fergus FI 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0421	Term equip	Replace equip	2 ea	200	71,634
	963	1200	2163	Ft Ridgely-Franklin 115 @ 110% of 139	Franklin-Helena 345	0.0288	Conductor	Reconductor	25.7 mi	3,084	74,718
	968	1200	2168	Loon Tp-Eastwood 115 @ 110% of 310	Lk Marion 345/115 tx	0.0393	Conductor	Add 2nd tx	1.0 ea	7,000	81,718
	1013	1200	2213	Winnebago-Winnebago S 161 @ 110% of 161	Prairie Island-Byron 345	0.0225	??			0	81,718
	1026	1200	2226	Sheyenne-Audubon 230 @ 110% of 318	Wahpeton-Fergus Fls 230	0.0350	Conductor	Reconductor	43.9 mi	5,268	86,986
24	1062	1200	2262	Wilmarth-Helena 345 @ 110% of 1165	Franklin-Helena 345	0.3156	Conductor	Reconductor	39.0 mi	7,020	94,006

1200 1200 2400 (none)

0 94,006

Notes

1. TLTG analysis run on Summer 2011 off-peak powerflow case representing 1200 MW of "existing" Buffalo Ridge area gen.
Total SW MN Buffalo Ridge area gen = 1160 + 40 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 345 kV, Hazel-Granite Falls/Minn Valley 230 kV.
8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE

10/7/2005

Southwest Minnesota-->Twin Cities EHV Development

Existing Configuration--Big Stone at 230 kV
Option 31A "incremental" improvements in service

Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR

SW MN Buffalo Ridge Area Generation										Installed Cost, \$1,000's	
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	distribution factor	Limiting factor	Remedy	qty	item	cumulative
	-2825	1200	-1625	Wilmarth-Eastwood 115 kV @ 110% of 194	Wilmarth-Dome 115	0.0404	Conductor	Reconductor	4.4 mi	528	528
	-1645	1200	-445	Hoot Lk-Fergus Fls 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0193	Conductor	Reconductor	2.1 mi	252	780
2	-1381	1200	-181	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0257	Conductor	Rebuild	11.3 mi	3,955	4,735
4	-1212	1200	-12	Maynard-Kerkhoven Tp 115 @ 110% of 78	Granite Falls-Willmar 230	0.0296	Conductor	Rebuild	14.7 mi	5,145	9,880
	-1114	1200	86	Granite Falls-Minn Valley 230 @ 110% of 388	Granite Falls-Willmar 230 & Willmar 230/69 tx	0.1072	Conductor	Reconductor	2.5 mi	300	10,180
3	-1102	1200	98	Paynesville-Roscoe 69 @ 110% of 47	Paynesville-Wakefield 115	0.0236	Conductor	(Opt 31A facility)		0	10,180
6	-1040	1200	160	Grant Co-Morris 115 @ 110% of 96	Fergus Falls-Wahpeton 230 & Wahpeton tx	0.0338	Conductor	Reconductor	26.5 mi	3,180	13,360
8	-1006	1200	194 R	Grant Co-Morris 115 @ 110% of 96	Fergus Falls-Wahpeton 230	0.0323				0	13,360
7	-893	1200	307	Roscoe-Munson 69 @ 110% of 47	Paynesville-Wakefield 115	0.0236	Conductor	(Opt 31A facility)		0	13,360
11	-681	1200	519	Farm Tp-Munson Tp @ 110% of 47	Paynesville-Wakefield 115	0.0236	Conductor	(Opt 31A facility)		0	13,360
14	-573	1200	627	Minn Valley-Panther 230 @ 110% of 388	Wilmarth-Lakefield Gen 345	0.1152	Conductor	Reconductor	30.2 mi	3,624	16,984
10	-545	1200	655	Willmar 230/69 tx @ 130% of 84	Willmar-Kandiyohti 230	0.0209	Transformer	Install 2nd tx	1.0 ea	3,000	19,984
	-481	1200	719	Grant Co-Elbow Lk 115 @ 110% of 160	Henning-Fergus Fls 230	0.0252	Clearance	upgrade structures	3.6 mi	360	20,344
21	-316	1200	884	Henning-Fergus Fl 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0559	Term equip	Replace equip	2.0 ea	200	20,544
	-257	1200	943	Minn Valley 230/115 tx # 6	Granite Falls-Minn Valley 230	0.0593	Transformer	Replace tx	1.0 ea	2,000	22,544
	-162	1200	1038	Sheyenne-Audubon 230 @ 110% of 318	Wahpeton-Fergus Fls 230	0.0451	Conductor	Reconductor	43.9 mi	5,268	27,812
1	-128	1200	1072	Granite Falls-Willmar 230 @ 110% of 388	Minn Valley-Panther 230	0.0922	Conductor	Reconductor	31.0 mi	3,720	31,532
	-84	1200	1116	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230 & Willmar 230/69 tx	0.0228	Transformer	Install 2nd tx	1.0 ea	3,000	34,532
	-72	1200	1128	Morris 230/115 tx #1 or 2 @ 130% of 100	Morris 230/115 tx #2 or 1	0.0245	Transformer	install larger tx	1.0 ea	400	34,932
	-70	1200	1130	Elbow Lk-Brandon 115 @ 110% of 160	Henning-Fergus Fls 230	0.0256	Clearance	upgrade structures	16.6 mi	1,660	36,592
13	20	1200	1220	Canby-Burr 115 @ 110% of 97	Canby-Big Stone 230	0.0976	Conductor	Rebuild	4.8 mi	1,680	38,272
	34	1200	1234	Loon Tp-Eastwood 115 @ 110% of 310	Byron 345/161 tx	0.0420	Conductor	Rebuild to 600 MV,	22.0 mi	11,000	49,272
22	53	1200	1253	McLeod-Panther 230 @ 110% of 388	Wilmarth-Lakefield Gen 345	0.1137	Conductor	Reconductor	28.2 mi	3,384	52,656
17	82	1200	1282	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Sherco #3 gen	0.3287	Conductor	Reconductor	54.2 mi	9,756	62,412
	107	1200	1307	Heron Lk-Brewster 161 @ 110% of 112	Lakefield Jct-Nobles Co 345	0.0289	Conductor	Rebuild	14.0 mi	4,900	67,312
18	110	1200	1310	St Cloud TpW-Wakefield 115 @ 110% of 113	Wilmarth-Lakefield Gen 345	0.0606	Conductor	Reconductor	13.8 mi	1,518	68,830
	137	1200	1337	Wahpeton-Fergus Fls 230 @ 110% of 320	Sheyenne-Audubon 230	0.0527	Term equip	Replace equip	2.0 ea	200	69,030
	160	1200	1360	Ortonville-Johnson Jct 230 @ 110% of 390	Canby-Granite Falls 230	0.0943	Conductor	Install larger wire	24.7 ea	1,235	70,265
	304	1200	1504	Johnson Jct-Morris 230 @ 110% of 390	Canby-Granite Falls 230	0.0943	Conductor	Install larger wire	15.4 mi	770	71,035
	361	1200	1561	Brandon-Alex SS 115 @ 110% of 160	Henning-Fergus Fls 230	0.0252	Clearance	upgrade structures	13.0 mi	1,300	72,335
	394	1200	1594	Blue Lk-McLeod 230 @ 110% of 388	Wilmarth-Lakefield Gen 345	0.0866	Conductor	Reconductor	46.0 mi	5,520	77,855
	467	1200	1667	Burr-Marietta 115 @ 110% of 96	Canby-Burr 115	0.1500	Conductor	Rebuild	21.5 mi	7,525	85,380
	478	1200	1678	Marietta-Big Stone 115 @ 110% of 96	Canby-Burr 115	0.1500	Conductor	Rebuild	24.1 mi	8,435	93,815
	514	1200	1714	Farm Tp-Richmond 69 @ 110% of 48	Paynesville-Wakefield 115	0.0216	Conductor	Reconductor	0.1 mi	12	93,827
	547	1200	1747	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0680	transformer	Replace tx	1.0 ea	3,000	96,827
	597	1200	1797	Circle Tp-Fair Pk 69 @ 110% of 84	Blue Lk-Wilmarth 345 & Hyland Lk-Dean Lk 115	0.0201	Conductor	Reconductor	5.1 mi	612	97,439
	600	1200	1800	LeSauk Tp-Long Prairie 115 @ 110% of 98	Inman-Wing River 230	0.0252					97,439
	637	1200	1837	Magnolia-Elk 161 @ 110% of 167	Lakefield Jct-Nobles Co 345	0.0353	Conductor	Reconductor	26.7 mi	3,204	100,643

664	1200	1864	Big Stone-Ortonville 230 @ 110% of 390	Big Stone-Blair 230	0.0243	Conductor	Install larger wire	2.0 mi	100	100,743
671	1200	1871	Blue Heron-Richmond 69@ 110% of 48	Paynesville-Wakefield 115	0.0216	Conductor	Reconductor	3.8 mi	456	101,199
682	1200	1882	Magnolia-Split Rk tp 161 @ 110% of 200	Nobles Co-Lakefield 345	0.0401	Conductor	Reconductor	15.0 mi	1,800	102,999
682	1200	1882	Hutch MN-Hutch 3M 115 @ 110% of 174	Blue Lk 230/115 tx or BLL-McLeod 230	0.0452	Conductor	Reconductor	0.76 mi ?	91	103,090
717	1200	1917	Dawson-Canby 115 @ 110% of 94	Canby 230/115 tx	0.1110	Conductor	Reconductor	21.2 mi	2,544	105,634
720	1200	1920	Toronto-Burr 115 kV @ 100% of 144	(system intact)	0.2143	Conductor	Reconductor	24.7 mi	2,964	108,598
784	1200	1984	Big Stone-Blair 230 @ 110% of 480	Hazel-Canby 230	0.0813	Conductor	Reconductor	33.2 mi	3,984	112,582
785	1200	1985	Wilmarth-Blue Lk 345 @ 110% of 1165	Loon Tp-Eastwood 115	0.3149					

Notes

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Total SW MN Buffalo Ridge area gen = 1160 + 40 = 1200 MW.
2. Xcel/NSP Buffalo Ridge area line ratings adjusted per NSP wind rating practice.
3. Improvements modeled: none
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher.
Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel 230 kV, Hazel-Granite Falls/Minn Valley 230 kV.
8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE

8/15/2005

Presumed facility addition/upgrade costs (\$1,000's)

Reconductor to 795 kcm ACSS				120
Reconductor to 2 x 795 kcm ACSS				180
Reconductor to 477 kcm ACSS				110
Reconductor to 477 kcm ACSR				100
	69 kV	115 kV	230 kV	
Rebuild to 795 kcm ACSS single ckt				350
Rebuild to 2 x 795 kcm ACSS single ckt				500

Southwest Minnesota-->Twin Cities EHV Development

Base Configuration

Option 31A "incremental" improvements in service
 Brookings Co-Lyon Co-Franklin-Helena-Lk Marion/Black Dog 345 kV single circuit
 with Lyon Co-Lk Yankton & Lyon Co-Hazel 345 kV
 Big Stone-Canby-Hazel @ 230 kV, 2 x 795 ACSR
With Lk Marion-Black Dog 345 kV

SW MN Buffalo Ridge Area Generation						distribution	Limiting	Remedy	qty	Installed	Cost, \$1,000's
Key	TLTG Limit MW	Base Case MW	System Limit MW	Limiting Facility	Contingency	factor	factor			item	cumulative
1	-1616	1200	-416	Granite Falls-Willmar 230 @ 110% of 239	Sherco #3 gen	0.0291	terminal equip	Replace equip	ea		
2	-709	1200	491	Minn Valley-Maynard 115 @ 110% of 78	Granite Falls-Willmar 230	0.0173	Conductor	Rebuild	mi		
3	-563	1200	637	Paynesville-Roscoe 69 @ 110% of 47	Paynesville-Wakefield 115	0.0168	Conductor	(Opt 31A facility)			
4	-474	1200	726	Maynard-Kerkhoven Tp 115 @ 110% of 78	Granite Falls-Willmar 230	0.0199	Conductor	Rebuild			
5	-392	1200	808	Lake Marion-Kenrick 115 @ 110% of 139	Blue Lk-Parkers Lk 345 & Blue Lk-Eden Prairie 345 & Eden Pr tx	0.0291	Conductor	Rebuild as part of Lake Marion			
7	-309	1200	891	Roscoe-Munson 69 @ 110% of 47	Paynesville-Wakefield 115	0.0168	Conductor	(Opt 31A facility)			
6	-303	1200	897	Grant Co-Morris 115 @ 110% of 96	Maple River-Fergus Fls 230 & Fergus Fl-Wahpeton 230 & Wahpeton	0.0238	Conductor	Reconductor	mi		
8	-261	1200	939 R	Grant Co-Morris 115 @ 110% of 96	Wahpeton-Fergus Fls 230	0.0229					
10	-113	1200	1087	Willmar 115/69 tx @ 130% of 112	Granite Falls-Willmar 230	0.0210	Transformer	Install 2nd tx			
9	-68	1200	1132	Kenrick-Dakota Heights 115 @ 110% of 139	Blue Lk-Parkers Lk 345 & Blue Lk-Eden Prairie 345 & Eden Pr tx	0.0291	Conductor	Rebuild as part of Lake Marion-Black Dog 345			
11	-41	1200	1159	Farm Tp-Munson Tp @ 110% of 47	Paynesville-Wakefield 115	0.0168	Conductor	(Opt 31A facility)			
14	53	1200	1253	Minn Valley-Panther 230 @ 110% of 388	Lyon Co-Franklin 345	0.0786	Conductor	Reconductor	mi		
15	232	1200	1432	Helena-Blue Lk 345 @ 110% of 1165	Helena-Lk Marion 345	0.3983	Conductor	Reconductor	mi		
13	244	1200	1444	Canby-Burr 115 @ 110% of 97	Brookings Co-Toronto 115	0.1546	Conductor	Reconductor	mi		
16	569	1200	1769	Toronto-Burr 115 @ 110% of 144	Brookings Co-Toronto 115	0.2143	Conductor	Reconductor	mi		
	589	1200	1789	Eden Prairie 345/115 tx #9 @ 130% of 448	Parkers Lk-Blue Lk & Parkers Lk-Eden Pr 345 kV & Eden Pr 345/115 #10	0.0785					
21	601	1200	1801	Henning-Fergus Fl 230 @ 110% of 320	Audubon-Hubbard 230 & Hubbard tx	0.0408					
17	641	1200	1841	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Lyon Co-Franklin 345	0.3721	Conductor	Stop?			
18	644	1200	1844	St Cloud TpW-Wakefield 115 @ 110% of 113	Franklin-Helena 345	0.0478	Conductor				
19	706	1200	1906 R	Wilmarth-Lakefield Gen 345 @ 110% of 1165	Franklin-Helena 345	0.3707	Conductor				
20	788	1200	1988	Burnsville- Dakota Hgts @ 110% of 139	Blue Lk-Parkers Lk 345 & Blue Lk-Eden Prairie 345 & Eden Pr tx	0.0291	Conductor	Rebuild as part of Lake Marion-Black Dog 345			
22	822	1200	2022	McLeod-Panther 230 @ 110% of 388	Franklin-Helena 345	0.0787					
	863	1200	2063	Sheyenne-Audubon 230 @ 110% of 318	Wahpeton-Fergus Fls 230	0.0334					
24	1019	1200	2219	Wilmarth-Helena 345 @ 110% of 1165	Franklin-Helena 345	0.3416					
23	1078	1200	2278	Brookings Co-Toronto 115 @ 110% of 310	Hazel-Canby 230	0.1962					
	1178	1200	2378	Ortonville-Johnson Jct 230 @ 110% of 390	Hazel-Canby 230	0.0614					
12	1189	1200	2389	Winnebago-Winnebago S 161 @ 110% of 161	Prairie Island-Byron 345	0.0244	??				
	1200	1200	2400	(none)							

Notes

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3. Improvements modeled: "Incremental" Option 31A facilities, plus Brookings Co-Twin Cities 345 kV, 2nd YKE-Brookings 115 kV
4. Limiters listed include all which have distribution factor (PTDF or OTDF) of 0.0200 or higher. Includes 60% series compensation of Wilmarth-Lakefield Gen 345 kV
6. Big Stone 2 = 600 MW net
7. Big Stone 2 outlet: Big Stone-Morris 230 kV, Big Stone-Canby-Hazel-Granite Falls/Minn Valley 230 kV.

8. Wilmarth-Helena 345 outage presumed to result in tripping of Wilmarth Calpine gen (cross-tripping scheme).

R Gonzalez, PE

8/15/2005

**SW Minnesota Generation Outlet
Installed Cost (\$1,000's)
Thermal fixes only
(not including cost of new 345kV)**

