

Affected System Limited Operation Impact Study for MISO Generator Interconnection

J400

**October 2016
Generator Interconnection**

Revision History

Date	Author	Change Description
10/11/2016	SPP	Affected System Limited Operation Impact Study (LOIS) for MISO Generator Interconnection Request J400 Report Revision 0 Issued

Executive Summary

<OMITTED TEXT> (Affected System Interconnection Customer) has requested an Affected System Limited Operation System Impact Study (AS-LOIS) consistent with Southwest Power Pool Open Access Transmission Tariff (OATT) for 62.5 MW of solar generation, known as J400, to be interconnected with 62.5 MW of Network Resource Interconnection Service (NRIS) to the Midcontinent Independent System Operator (MISO) transmission system footprint. J400 is planned to interconnect into the transmission system of Xcel Energy (XEL) in Lyon County, Minnesota. Affected System Interconnection Customer has requested this Affected System Limited Operation Interconnection Study (AS-LOIS) to determine the impacts of interconnecting J400 to the transmission system under the following assumptions:

- GEN-2015-023 generation in-service is after the in-service of planned Gentleman – Thedford – Holt 345kV (“R-Plan”) Project

Gentleman – Thedford – Holt (“R-Plan”) Project is currently scheduled to be in-service by 1/2019. Should any assumptions or scheduled in-service dates change or be delayed, this Affected System Limited Operation Impact Study (AS-LOIS) will require to be re-evaluation.

This Affected System LOIS addresses the effects to the rest of the transmission system of interconnecting the generator for the system topology and conditions as expected in 3rd Quarter of 2016. Affected System Interconnection Customer is requesting the interconnection of 62.5 MW of generation comprised of eighty-four (84) 0.75 MW solar photovoltaic (PV) inverters and associated facilities interconnecting at the XEL Lyon County 115kV substation in Lyon County, Minnesota. For this Affected System LOIS, only power-flow analysis was conducted. The Affected System LOIS assumes that only the higher-queued projects listed within Table 1 of this study might go into service before the completion of all Network Upgrades identified within Table 2 of this report. If additional generation projects listed in Table 3 with queue priority equal-to or higher-than the study project, request to go into commercial operation before all Network Upgrades identified within

Table 2 of this report are completed, this Affected System LOIS may need to be restudied to ensure that interconnection service remains available for the customer’s request.

Power-flow analysis from this Affected System LOIS has determined that the J400 request can interconnect 62.5 MW of Network Resource Interconnection Service (NRIS) prior to the completion of the required Network Upgrades, listed within

Table 2 of this report, provided that the Network Upgrades are able to be placed in service should GEN-2015-023 and J400 both be in-service. Should any other projects, other than those listed within Table 1 of this report, come into service, an additional study may be required to determine if any affected system limited operation service is available. It should be noted that although this Affected System LOIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Additionally, the generator may not be able to inject any power onto the Transmission System due to constraints that fall below the threshold of mitigation for a Generator Interconnection request. Because of this, the Customer may be required by the

Transmission Provider to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Transient stability and short circuit analysis was not performed for this AS-LOIS study.

Nothing in this study should be construed as a guarantee of delivery or transmission service within Southwest Power Pool's (SPP) transmission system. If the customer wishes to sell power from the facility, a separate request for transmission service must be requested on Southwest Power Pool's OASIS by the Customer.

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Purpose

<OMITTED TEXT> (Affected System Interconnection Customer) has requested an Affected System Limited Operation System Impact Study (AS-LOIS) consistent with the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT) for interconnection requests into the transmission system of Xcel Energy (XEL).

The purpose of this study is to evaluate the impacts of interconnecting J400 request with a total of 62.5 MW comprised of eighty-four (84) 0.75 MW solar photovoltaic (PV) inverters and associated facilities interconnecting at the XEL Lyon County 115kV substation in Lyon County, Minnesota. The Affected System Interconnection Customer has requested this amount to be studied with 62.5 MW of Network Resource Interconnection Service (NRIS) to commence on or around 3rd Quarter of 2016. Additionally, the Affected System Interconnection Customer has requested this Affected System LOIS analysis be conducted under the following assumptions:

- GEN-2015-023 generation in-service is after the in-service of planned Gentleman – Thedford – Holt 345kV (“R-Plan”) Project

Gentleman – Thedford – Holt (“R-Plan”) Project is currently scheduled to be in-service by 1/2019. Should any assumptions or scheduled in service dates change or be delayed, this Affected System Limited Operation Impact Study (AS-LOIS) will be required to be re-evaluated.

Only power flow analysis was conducted for this Affected System Limited Operation Interconnection Service. Limited Operation Studies are conducted under GIA Section 5.9.

The AS-LOIS considers the Base Case as well as all Generating Facilities (and with respect to (b) below, any identified Network Upgrades associated with such higher-queued interconnection) that, on the date the LOIS is commenced:

- a) are directly interconnected to the Transmission System;
- b) are interconnected to Affected Systems and may have an impact on the Interconnection Request;
- c) have a pending higher-queued Interconnection Request to interconnect to the Transmission System listed in Table 1; or
- d) have no Queue Position but have executed an LGIA or requested that an unexecuted LGIA be filed with FERC.

Any changes to these assumptions, for example, one or more of the previously queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this LOIS at the expense of the Customer.

Nothing within this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service rights within Southwest

Power Pool's (SPP) transmission system. Should the Customer require transmission service, those rights should be requested through SPP's Open Access Same-Time Information System (OASIS).

This AS-LOIS study included prior queued generation interconnection requests. Those listed within Table 1 are the generation interconnection requests that are assumed to have rights to either full or partial interconnection service prior to in-service for this AS-LOIS. Also listed in Table 1 are both the amount of MWs of interconnection service expected at the effective time of this study and the total MWs requested of interconnection service, the fuel type, the point of interconnection (POI), and the current status of each particular prior queued request.

Table 1: Generation Requests Included within LOIS

Project	Studied MW	Total MW	Fuel Source	POI	Status
G132	180	180	Wind	Ellendale Sub 230 kV	IA Fully Executed/Commercial Operation
G255	100	100	Wind	Yankee Substation	IA Fully Executed/Commercial Operation
G263	105	105	Wind	Lakefield Generating Substation	IA Fully Executed/Commercial Operation
G287	200	200	Wind	Nobles County Substation	IA Fully Executed/Commercial Operation
G349	200	200	Wind	Brookings County Substation	IA Fully Executed/Commercial Operation
G362	200	200	Wind	Pleasant Valley Substation	IA Fully Executed/Commercial Operation
G370	205	205	Gas	Anson 4	IA Fully Executed/Commercial Operation
G380	150	150	Wind	Rugby 115kV Substation	IA Fully Executed/Commercial Operation
G386	100	100	Wind	Lakefield Substation 345kV	IA Fully Executed/Commercial Operation
G389	200	200	Gas	Elk River 230 kV substation	IA Fully Executed/Commercial Operation
G514	150	150	Wind	Lakefield Station via Trimont G263 Interconnect	IA Fully Executed/Commercial Operation
G540	80	80	Wind	Adams - Lime Creek 161 kV	IA Fully Executed/Commercial Operation
G548	80	80	Wind	Barton 161kV Substation	IA Fully Executed/Commercial Operation
G549	20	20	Wind	Next to Williams Substation (69kV)	IA Fully Executed/On Schedule
G551	99	99	Wind	Rice 161 kV	IA Fully Executed/Commercial Operation
G573	80	80	Wind	Franklin 161 kV Substation	IA Fully Executed/Commercial Operation
G574	80	80	Wind	Franklin 161 kV Substation	IA Fully Executed/Commercial Operation
G575	40	40	Wind	Franklin 161 kV Substation	IA Fully Executed/Commercial Operation
G586	30	30	Wind	Xcel New Yankee Sub 34.5 kV	IA Fully Executed/Commercial Operation
G595	150	150	Wind	Lime Creek 161 kV Substation	IA Fully Executed/Commercial Operation

Table 1: Generation Requests Included within LOIS

Project	Studied MW	Total MW	Fuel Source	POI	Status
G602	32	32	Wind	Nobles County 115 kV Substation	IA Fully Executed/Commercial Operation
G604	44	44	Wind	Owatonna - County Line 69 kV	IA Fully Executed/Commercial Operation
G612	150	150	Wind	ITC Midwest Fernald 115 kV Substation	IA Fully Executed/Commercial Operation
G619	50	50	Wind	GRE Tamarac 41 kV Substation	IA Fully Executed/Commercial Operation
G620	19	19	Wind	Kenyon - Dodge 69 kV	IA Fully Executed/On Schedule
G621	20	20	Wind	Rock Tap – South Ridge 69kV	IA Fully Executed/On Schedule
G667	13	13	Wind	Round Lake Tap 69kV	IA Fully Executed/On Schedule
G685	20	20	Wind	Lake Lillian-Atwater 69kV	IA Fully Executed/Commercial Operation
G735	200	200	Wind	Lime Creek Substation	IA Fully Executed/Commercial Operation
G741	8	8	Waste Heat	Alliant 69kV	IA Fully Executed/Commercial Operation
G752	150	150	Wind	Bison-Hettinger 230kV	IA Fully Executed/Commercial Operation
G788	49	49	Wind	Ladish 115kV	IA Fully Executed/Commercial Operation
G798	150	150	Wind	Fernald 115kV Substation	IA Fully Executed/Commercial Operation
G826	200	200	Wind	Lakefield Generation SW – Lakefield Junction 345kV	IA Fully Executed/Commercial Operation
G830	99	99	Wind	McHenry 115kV Substation	IA Fully Executed/On Schedule
G858			Wind	Black Oak 69 kV Substation	IA Fully Executed/On Schedule
G870	201	201	Wind	Hayward – Winnebago 161kV	IA Fully Executed/Commercial Operation
G929	60	60	Nuclear	Monticello	IA Fully Executed/Commercial Operation
G930	60	60	Coal	Sherco	IA Fully Executed/Commercial Operation
G947	99	99	Wind	Whispering Willows 161kV Substation	IA Fully Executed/Commercial Operation
G971	20	20	Wind	Cosmos Township 69kV	IA Fully Executed/Commercial Operation
G997	50	50	Wind	Minden Substation	IA Fully Executed/Commercial Operation
H007	41	41	Wind	Edgewood 69kV	IA Fully Executed/Commercial Operation
H008	36	36	Wind	Richfield 69kV Substation	IA Fully Executed/Commercial Operation
H009	150	150	Wind	Traer – Marshalltown 161kV	IA Fully Executed/Commercial Operation
H021	138.6	138.6	Wind	Wellsburg 115kV Substation	IA Fully Executed/Commercial Operation
H071	40	40	Wind	Black Oak 69 kV Substation	IA Fully Executed/On Schedule

Table 1: Generation Requests Included within LOIS

Project	Studied MW	Total MW	Fuel Source	POI	Status
H078	121	121	Wind	New Sub in Laurel, IA	IA Fully Executed/Commercial Operation
H092	60	60	Coal	Boswell	IA Fully Executed/Commercial Operation
H081	201	201	Wind	Brookings County – Lyon County 345kV	IA Fully Executed/On Schedule
H096	50	50	Wind	Grand Junction – Perry 161kV	IA Fully Executed/Commercial Operation
J020	20	20	Diesel		IA Fully Executed/Commercial Operation
J021	40	40	Diesel		IA Fully Executed/Commercial Operation
J075	150	150	Wind	Bauer - Rapson 345 kV	IA Fully Executed/Commercial Operation
J091	66	66	Wind	Lime Creek 161kV substation	IA Fully Executed/Commercial Operation
J110	7.5	7.5	Biomass	Glen Ullin	IA Fully Executed/Commercial Operation
J112	4.95	4.95	Wind	DPC Utica – Lewiston 69kV	IA Fully Executed/Commercial Operation
J161	155	155	Wind	Bauer - Rapson 345 kV	IA Fully Executed/Commercial Operation
J171	12	12	Biomass	Benson 115kV Substation	IA Fully Executed/Commercial Operation
J183	200	200	Wind	Split Rock Substation	IA Fully Executed/Commercial Operation
J191	101.2	101.2	Wind	Rolling Hills 345kV Substation	IA Fully Executed/Commercial Operation
J200	75	75	Gas	RM Heskett Station 115kV & 41.6kV	IA Fully Executed/Commercial Operation
J201	20	20	Wind	Manning 138kV Substation	IA Fully Executed/Commercial Operation
J202	101	101	Wind	Atlanta - Tuscola 115 kV	IA Fully Executed/Commercial Operation
J226	70	70	Hydro	Ludington Substation	IA Fully Executed/Commercial Operation
J231	70	70	Hydro	Ludington Substation	IA Fully Executed/On Schedule
J233	635	635	CC	Marshalltown 161kV	IA Fully Executed/On Schedule
J235	110	110	Wind	Bauer - Rapson 345 kV	IA Fully Executed/Commercial Operation
J238	725	725	Gas	Eagle Valley 138kV Substation	IA Fully Executed/On Schedule
J241	3.7	3.7	Hydro	Twin Falls Substation	IA Fully Executed/Commercial Operation
J249	180	180	Wind	MDU Tatanka Substation	IA Fully Executed/Commercial Operation
J256	8	8	Gas	NIPSCO Plymouth 69kV	IA Fully Executed/Commercial Operation
J262	100	100	Wind	Jamestown 345/115 kV substation	IA Fully Executed/Commercial Operation
J263	100	100	Wind	Jamestown 345/115 kV substation	IA Fully Executed/Commercial Operation

Table 1: Generation Requests Included within LOIS

Project	Studied MW	Total MW	Fuel Source	POI	Status
J274	100	100	Wind	Tap Winterset – Creston 161kV	IA Fully Executed/Commercial Operation
J278	200	200	Wind	Pleasant Valley 161kV	IA Fully Executed/Commercial Operation
J279	(Uprate) 30	(Uprate) 30	Coal	Raun 345kV	IA Fully Executed/Commercial Operation
J290	150	150	Wind	Tap Rugby – Glenboro 230kV	IA Fully Executed/Commercial Operation
R15	80	80	Wind	Pomeroy 161 kV substation	IA Fully Executed/Commercial Operation
R23	100	100	Wind	Monona - Carroll 161 kV	IA Fully Executed/Commercial Operation
R26	146	146	Wind	MEC Cooper - Booneville 345 kV	IA Fully Executed/Commercial Operation
R34	250	250	Wind	Council Bluffs - Madison County 345 kV	IA Fully Executed/Commercial Operation
R38	200	200	Wind	MEC Council Bluffs - Grimes 345 kV	IA Fully Executed/Commercial Operation
R39	500	500	Wind	Raun - Lakefield Junction	IA Fully Executed/Commercial Operation
R41	100	100	Wind	MEC Council Bluffs - Grimes 345 kV	IA Fully Executed/Commercial Operation
R42	250	250	Wind	Lehigh 345kV Substation	IA Fully Executed/Commercial Operation
R49	12	12	Wind	Pomeroy Generating Station	IA Fully Executed/Commercial Operation
R65	92	92	Wind	R34 Expansion	IA Fully Executed/Commercial Operation
J285	250	250	Wind	Proposed O'Brien 345 kV Sub	IA Fully Executed/Commercial Operation
J289	20	20	Wind	161 kV substation on Winterset Junction to Creston 161 kV line	IA Fully Executed/Commercial Operation
J316	150	150	Wind	MDU Tatanka – Ellendale line	IA Fully Executed/On Schedule
J320	55	55	Gas	High Bridge 115 kV Sub	IA Fully Executed/Commercial Operation
J329	55	55	Hydro	Pella West 69 kV Substation	IA Fully Executed/On Schedule
J343	150	150	Wind	161 kV substation on Creston – Clarinda 161 kV line	IA Fully Executed/Commercial Operation
J344	169	169	Wind	161 kV substation on Poweshiek – Oskaloosa 161 kV line	IA Fully Executed/On Schedule
J382	48.3	48.3	Gas	Christiana Switching Station	IA Fully Executed/Commercial Operation
G736	200	200	Wind	Big Stone South 230kV Substation	
J299	73	73	Gas	Wilmarth Substation	IA Fully Executed/On Schedule
J385	100 (100 NRIS)	100 (100 NRIS)	Solar	Chisago 115kV Substation	PGIA Executed
J391	50	50	Gas	MMU's N 7th Street substation	Under Study
J405	40 (18.2 NRIS)	40 (18.2 NRIS)	Gas	MDU's existing Lewis & Clark Jct. 115kV Substation	PGIA/Commercial Operation
J407	200	200	Wind	Glenworth 161 kV substation	Under Study
J411	300	300	Wind	LeHigh - Raun 345 kV Line	Under Study

Table 1: Generation Requests Included within LOIS

Project	Studied MW	Total MW	Fuel Source	POI	Status
J416	200	200	Wind	Emery - Blackhawk 345 kV Line	IA Fully Executed/On Schedule
J426	100	100	Wind	Chanarambie substation 35.4 kV	Under Study
MPC01200	98.9	98.9	Wind	Pomeroy Generating Station	IA Fully Executed/Commercial Operation for 54.9MW. IA Pending for remaining 44MW
MPC02100	99.3	99.3	Wind	R34 Expansion	On schedule for 2016
GEN-2002-009IS (GI-0209)	40.5	40.5	Wind	Proposed O'Brien 345 kV Sub	IA Fully Executed/Commercial Operation
GEN-2003-021N	75	75	Wind	161 kV substation on Winterset Junction to Creston 161 kV line	IA Fully Executed/Commercial Operation
GEN-2004-023N	75	75	Coal	MDU Tatanka – Ellendale line	IA Fully Executed/Commercial Operation
GEN-2005-008IS (GI-0508)	49.5	49.5	Wind	High Bridge 115 kV Sub	IA Fully Executed/Commercial Operation
GEN-2006-015IS (GI-0615)	49.5	49.5	Wind	Pella West 69 kV Substation	IA Fully Executed/Commercial Operation
GEN-2006-020N	42	42	Wind	161 kV substation on Creston – Clarinda 161 kV line	IA Fully Executed/Commercial Operation
GEN-2006-037N1	75	75	Wind	161 kV substation on Poweshiek – Oskaloosa 161 kV line	IA Fully Executed/Commercial Operation
GEN-2006-038N005	80	80	Wind	Christiana Switching Station	IA Fully Executed/Commercial Operation
GEN-2006-038N019	80	80	Wind	Petersburg North 115kV	IA Fully Executed/Commercial Operation
GEN-2006-044N	40.5	40.5	Wind	North Petersburg 115kV	IA Fully Executed/Commercial Operation
GEN-2007-011N08	81	81	Wind	Bloomfield 115kV	IA Fully Executed/Commercial Operation
GEN-2007-013IS (GI-0713)	50	50	Wind	Wessington Springs 230kV	IA Fully Executed/Commercial Operation
GEN-2007-014IS (GI-0714)	100	100	Wind	Wessington Springs 230kV	IA Fully Executed/Commercial Operation
GEN-2007-015IS (GI-0715)	100	100	Wind	Hilken 230kV	IA Fully Executed/Commercial Operation
GEN-2007-017IS (GI-0717)	166	166	Wind	Ft. Thompson-Grand Island 345kV	IA Fully Executed/On Schedule
GEN-2007-018IS (GI-0718)	234	234	Wind	Ft. Thompson-Grand Island 345kV	IA Fully Executed/On Schedule
GEN-2007-027IS (GI-0727)	99	99	Wind	Bismarck-Garrison 230kV #1	IA Fully Executed/On Suspension
GEN-2007-023IS (GI-0723)	49.5	49.5	Wind	Formit-Summit 115kV	IA Fully Executed/On Suspension
GEN-2008-086N02	201	201	Wind	Meadow Grove 230kV	IA Fully Executed/Commercial Operation
GEN-2008-119O	60	60	Wind	S1399 161kV	IA Fully Executed/Commercial Operation
GEN-2008-123N	89.7	89.7	Wind	Tap Pauline-Hildreth (Rosemont) 115kV	IA Fully Executed/On Schedule for 2016
GEN-2008-129	80	80	CT	Pleasant Hill 161kV	IA Fully Executed/Commercial Operation
GEN-2009-001IS (GI-0901)	200	200	Wind	Groton-Watertown 345kV	IA Fully Executed/On Schedule

Table 1: Generation Requests Included within LOIS

Project	Studied MW	Total MW	Fuel Source	POI	Status
GEN-2009-018IS (GI-0918)	100	100	Wind	Groton 115kV	IA Fully Executed/Commercial Operation
GEN-2009-026IS (GI-0926)	106.5	106.5	Wind	Dickinson-Heskett 230kV	IA Fully Executed/On Schedule
GEN-2009-040	73.8	73.8	Wind	Tap Smittyville-Knob Hill 115kV	IA Fully Executed/Commercial Operation
GEN-2010-001IS (GI-1001)	99	99	Wind	Bismarck-Glenham 230kV	IA Fully Executed/On Schedule
GEN-2010-003IS (GI-1003)	34	34	Wind	Wessington Springs 230kV	IA Fully Executed/Commercial Operation
GEN-2010-007IS (GI-1007)	172.5	172.5	Wind	Antelope 345kV	IA Fully Executed/On Suspension
GEN-2010-036	4.6	4.6	Hydro	6 th Street 115kV	IA Fully Executed/Commercial Operation
GEN-2010-041	10.5	10.5	Wind	S1399 161kV	IA Fully Executed/On Schedule
GEN-2010-051	200	200	Wind	Tap Twin Church-Hoskins 230kV	IA Fully Executed/On Schedule for 2018
GEN-2011-011	50	50	Coal	Iatan 345kV	IA Fully Executed/Commercial Operation
GEN-2011-018	73.6	73.6	Wind	Steele City 115kV	IA Fully Executed/Commercial Operation
GEN-2011-027	120	120	Wind	Tap Twin Church-Hoskins 230kV	IA Fully Executed/On Schedule for 2018
GEN-2011-056	3.6	3.6	Hydro	Jeffrey 115kV	IA Fully Executed/Commercial Operation
GEN-2011-056A	3.6	3.6	Hydro	John 1 115kV	IA Fully Executed/Commercial Operation
GEN-2011-056B	4.5	4.5	Hydro	John 2 115kV	IA Fully Executed/Commercial Operation
GEN-2012-006IS (GI-1206)	141	141	Gas	Williston-Charlie Creek 230kV	IA Fully Executed/On Schedule
GEN-2012-014IS (GI-1214)	99	99	Wind	Groton 115kV	IA Fully Executed/On Schedule
GEN-2012-021	4.8	4.8	Gas	Terry Bundy Generating Station 115kV	IA Fully Executed/Commercial Operation
GEN-2013-001IS (GI-1301)	90	90	Wind	Summit-Watertown 115kV	IA Fully Executed/On Suspension
GEN-2013-002	50.6	50.6	Wind	Tap Sheldon-Folsom & Pleasant Hill 115kV CKT 2	IA Fully Executed/On Schedule for 2016
GEN-2013-008	1.2	1.2	Wind	Steele City 115kV (GEN-2011-018 POI)	IA Fully Executed/Commercial Operation
GEN-2013-009IS (GI-1309)	19.5	19.5	Wind	Redfield 69kV	IA Fully Executed/Commercial Operation
GEN-2013-019	73.6	73.6	Wind	Tap Sheldon-Folsom & Pleasant Hill (GEN-2013-002 Tap) 115kV CKT 2	IA Fully Executed/On Schedule for 2016
GEN-2013-032	204	204	Wind	Antelope 115kV	IA Fully Executed/On Schedule for 2017
GEN-2014-001IS (GI-1401)	103	103	Wind	Newell-Maurine 115kV	IA Fully Executed/IA Pending
GEN-2014-004	4	4	Wind	Steele City 115kV (GEN-2011-018 POI)	IA Fully Executed/Commercial Operation
GEN-2014-004IS (GI-1404)	384.2	384.2	Wind	Charlie Creek 345kV	IA Fully Executed/IA Pending

Table 1: Generation Requests Included within LOIS

Project	Studied MW	Total MW	Fuel Source	POI	Status
GEN-2014-006IS (GI-1406)	113.28	113.28	Gas	Williston 115kV	IA Fully Executed/On Schedule for 2016
GEN-2014-010IS (GI-1410)	150	150	Wind	Neset 115kV	IA Fully Executed/On Schedule for 2016
GEN-2014-013	73.5	73.5	Wind	Meadow Grove (GEN-2008-086N2 Sub) 230kV	IA Fully Executed/Commercial Operation
GEN-2014-014IS (GI-1414)	149.73	149.73	Wind	Belfield-Rhame 230kV	IA Fully Executed/On Schedule for 2016
GEN-2014-021	300	300	Wind	Nebraska City - Mullin Creek 345kV	IA Fully Executed/On Schedule for 2016
GEN-2014-031	35.8	35.8	Wind	Meadow Grove 230kV	IA Fully Executed/Commercial Operation
GEN-2014-032	10.2	10.2	Wind	Meadow Grove 230kV	IA Fully Executed/On Schedule for 2016
GEN-2014-039	73.4	73.4	Wind	Friend 115kV	IA Fully Executed/On Schedule for 2017
GEN-2015-005	200.1	200.1	Wind	Nebraska City – Sibley 345kV	IA Fully Executed/On Schedule for 2016
GEN-2015-007	160	160	Wind	Hoskins 345kV	IA Fully Executed/IA Pending
J400	62.5	62.5	Solar	Lyon County 115kV Substation	Under Study

This AS-LOIS was required because the Affected System Interconnection Customer is requesting interconnection prior to the completion of all of higher queued assigned required upgrades listed within the latest iteration of SPP Affected System Impact Study for MISO DPP-FEB-2015 West. Table 2 below lists the required upgrade projects for which these requests have impacts to. J400 was included within SPP Affected System Impact Study for MISO DPP-FEB-2015 West that was studied in July 2016.

Table 2: Upgrade Projects not included but Required for Full Interconnection Service

Upgrade Project	Type	Description	Status	Study Assignment
Gentleman – Thedford – Holt County 345kV (“R-Plan”) Project	New line, transformer, and substation	Build approximately two hundred twenty seven (227) miles of new 345kV from Gentleman – Holt County. Install Thedford 345/115/13kV transformer, and built Holt County Substation	New ISD scheduled for 10/1/2018	2012 SPP Integrated Transmission Plan – 10 Year Assessment (ITP10)

Any changes to these assumptions, for example, one or more of the previously-queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this Affected System LOIS at the expense of the Affected System Interconnection Customer.

The higher or equally-queued projects that were not included in this study are listed in Table 3. While this list is not all-inclusive, it is a list of the most probable and affecting prior-queued requests that were not included within this AS-LOIS, either because no request for an LOIS has been made or the request is on suspension, etc.

Table 3: Higher or Equally Queued GI Requests not included within Affected System LOIS

Project	MW	Total MW	Fuel Source	POI	Status
GEN-2015-023	300.7	300.7	Wind	Holt County 345kV Substation	IA Pending

Nothing in this System Impact Study constitutes a request for transmission service or grants the Interconnection Customer any rights to transmission service to the SPP transmission system.

Facilities

Generating Facility

The Affected System Interconnection Customer's request to interconnect a total of 62.5 MW is comprised of eighty-four (84) 0.75 MW solar photovoltaic (PV) inverters and associated facilities.

Interconnection Facilities

The POI for J400 Affected System Interconnection Customer is the XEL Lyon County 115kV substation in Lyon County, Minnesota. *Figure 1* depicts the one-line diagram of the local transmission system including the POI as well as the power flow model representing the requests.

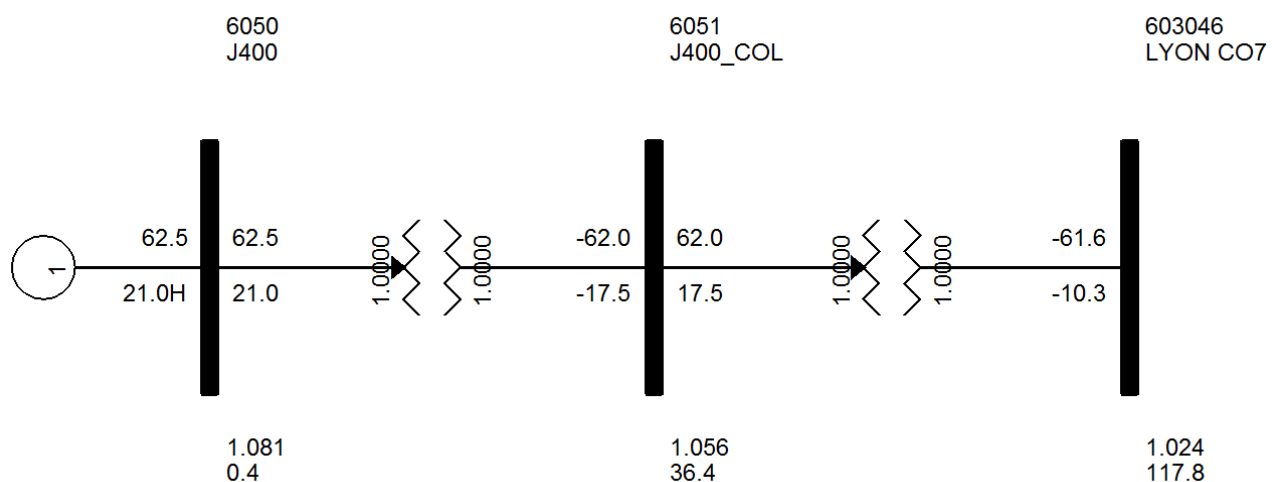


Figure 1: Proposed POI Configuration and Request Power Flow Model

Base Case Network Upgrades

The Network Upgrades included within the cases used for this Affected System LOIS study are those facilities that are a part of the SPP Transmission Expansion Plan, Balanced Portfolio, or Integrated System (IS) Integration Study projects that have in-service dates prior to the J400 requested in-service date of 3rd Quarter of 2016. These facilities have an approved Notification to Construct (NTC), or are in construction stages and expected to be in-service at the effective time of this study. No other upgrades were included for this AS-LOIS. If for some reason, construction on these projects is delayed or discontinued, a restudy may be needed to determine the interconnection service availability of the Customer.

Power Flow Analysis

Power flow analysis is used to determine if the transmission system can accommodate the injection from the request without violating thermal or voltage transmission planning criteria.

Model Preparation

Power flow analysis was performed using modified versions of the 2015 series of transmission service request study models including the 2016 Winter Peak (16WP), 2017 Spring (17G), and 2017 Summer Peak (17SP), 2020 Light (20L), and 2020 Summer (SP) and Winter (WP) peak seasonal models. To incorporate the Interconnection Customers' request, a re-dispatch of existing generation within SPP and MISO was performed with respect to the amount of the Customers' injection.

For Variable Energy Resources (VER) (solar/wind) in each power flow case, Energy Resource Interconnection Service (ERIS), is evaluated for the generating plants within a geographical area of the interconnection request(s) for the VERs dispatched at 100% nameplate of maximum generation. The VERs in the remote areas is dispatched at 20% nameplate of maximum generation. These projects are dispatched across the SPP footprint using load factor ratios.

Peaking units are not dispatched in the 2017 spring and 2020 light, or in the "High VER" summer and winter peaks. To study peaking units' impacts, the 2016 winter peak, 2017 summer peak, and 2020 summer and winter peaks and 2025 summer peak, models are developed with peaking units dispatched at 100% of the nameplate rating and VERs dispatched at 20% of the nameplate rating. Each interconnection request is also modeled separately at 100% nameplate for certain analyses.

All SPP generators (VER and peaking) that requested Network Resource Interconnection Service (NRIS) are dispatched in an additional analysis into the interconnecting Transmission Owner's (T.O.) area at 100% nameplate with Energy Resource Interconnection Service (ERIS) only requests at 80% nameplate. All MISO generators (VER and peaking) that requested Network Resource Interconnection Service (NRIS) are dispatched based on their respective NRIS amounts in an additional analysis into the MISO transmission system. This method allows for identification of network constraints that are common between regional groupings to have affecting requests share the mitigating upgrade costs throughout the cluster.

For this LOIS, only the previous queued requests listed in Table 1 were assumed to be in-service at 100% dispatch.

Study Methodology and Criteria

Network constraints are found by using PSS/E AC Contingency Calculation (ACCC) analysis with PSS/E MUST First Contingency Incremental Transfer Capability (FCITC) analysis on the entire cluster grouping dispatched at the various levels previously mentioned.

For Energy Resource Interconnection Service (ERIS), thermal overloads are determined for system intact (n-0) (greater than 100% of Rate A - normal) and for contingency (n-1) (greater than 100% of Rate B – emergency) conditions.

The overloads are then screened to determine which of generator interconnection requests have at least

- 3% Distribution Factor (DF) for system intact conditions (n-0),
- 20% DF upon outage based conditions (n-1),
- or 3% DF on contingent elements that resulted in a non-converged solution.

Interconnection Requests that requested Network Resource Interconnection Service (NRIS) are also studied in a separate NRIS analysis to determine if any constraint measured greater than or equal to a 3% DF. If so, these constraints are also considered for transmission reinforcement under NRIS.

The contingency set includes all SPP control area branches and ties 69kV and above, first tier Non-SPP control area branches and ties 115 kV and above, any defined contingencies for these control areas, and generation unit outages for the SPP control areas with SPP reserve share program redispatch.

The monitor elements include all SPP control area branches, ties, and buses 69 kV and above, and all first tier Non-SPP control area branches and ties 69 kV and above. NERC Power Transfer Distribution Flowgates for SPP and first tier Non-SPP control area are monitored. Additional NERC Flowgates are monitored in second tier or greater Non-SPP control areas. Voltage monitoring was performed for SPP control area buses 69 kV and above.

Notwithstanding, should any facility be identified by MISO using MISO Constraint Identification Criteria as being affected by a study request, such as “Outlet” constraints or other specific criteria, review and mitigation of those constraints may also be required.

As a note the SPP Permanent List of Flowgates are included within SPP Planning studies and can be reviewed on the SPP OASIS website. The direct link to the current Permanent Flowgate list is as follows: https://www.oasis.oati.com/SWPP/SWPPdocs/Permanent_flowgates.xls

Results

The LOIS ACCC analysis indicates that the Affected System Interconnection Customer can interconnect its generation into the XEL transmission system at 62.5 MW for NRIS before all required upgrades listed within the SPP Affected System Impact Study for MISO DPP-FEB-2015 West can be placed into service. Should any other GI projects, other than those listed within Table 1 of this report, come into service, an additional study may be required to determine if any limited operation service is available.

ACCC results for the LOIS can be found in Table 4. Table 4 power flow analysis results assume system conditions as of 3rd Quarter of 2016 without GEN-2015-023 and without advancing in-service for Network Upgrade(s) mentioned in Table 2. Under this assumption J400 could interconnect up to 62.5 MW of Network Resource Interconnection Service.

Curtailment and System Reliability

In no way does this study guarantee operation for all periods of time. It should be noted that although this study analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, the Customer may be required by the Transmission Provider to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

The “COOPER_S” flowgate is currently rated at 1465MVA and is comprised of the (NPPD) Cooper – (GMO) St. Joseph 345kV and the (NPPD) Cooper – (AECI) Fairport 345kV facilities. The flowgate is a PTDF flowgate designed to protect one of the associated facilities for an outage of the other facility. High loadings in the 2017 Summer Peak season were observed, should Nebraska City – Mullin Creek – Sibley 345kV for unforeseen reason have construction delays and is not in-service by December 31, 2016, then this AS-LOIS will be required to be re-evaluated. Once the SPP Nebraska City – Mullin Creek – Sibley 345kV comes into service the constraint may be alleviated. It is worth noting that at this time, it is unknown if the “COOPER_S” flowgate rating will be adjusted once this new line comes into service.

Power Flow Analysis

Table 4: Interconnection Constraints for Transmission Reinforcement Mitigation J400 @ 62.5MW without GEN-2015-023 as of 3rd Quarter 2016

Season	Dispatch Group	Source	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
				Currently no SPP Transmission Facilities observed in this LOIS.						

Stability Analysis

Transient stability analysis was not performed for this Affected System LOIS study.

Conclusion

<OMITTED TEXT> (Affected System Interconnection Customer) has requested an Affected System Limited Operation System Impact Study (AS-LOIS) consistent with Southwest Power Pool Open Access Transmission Tariff (OATT) for 62.5 MW of solar generation to be interconnected with 62.5 MW of Network Resource Interconnection Service (NRIS) to the Midcontinent Independent System Operator (MISO) transmission system footprint. J400 is planned to interconnect into the transmission system of Xcel Energy (XEL) in Lyon County, Minnesota. J400 has requested this Affected System Limited Operation Interconnection Study (AS-LOIS) to determine the impacts of interconnecting to the transmission system under the following assumptions:

- GEN-2015-023 generation in-service is after the in-service of planned Gentleman – Thedford – Holt 345kV (“R-Plan”) Project

Gentleman – Thedford – Holt (“R-Plan”) Project is currently scheduled to be in-service by 1/2019. Should any assumptions or scheduled in service dates change or be delayed, this Affected System Limited Operation Impact Study (AS-LOIS) will be required to be re-evaluated.

Power flow analysis from this Affected System LOIS has determined that the J400 request can interconnect 62.5 MW of Network Resource Interconnection Service (NRIS) prior to the completion of the required Network Upgrades, listed within

Table 2 of this report, provided that the Network Upgrades are able to be placed in service should GEN-2015-023 and J400 both be in-service. Should any other projects, other than those listed within Table 1 of this report, come into service, an additional study may be required to determine if any affected system limited operation service is available. It should be noted that although this Affected System LOIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Additionally, the generator may not be able to inject any power onto the Transmission System due to constraints that fall below the threshold of mitigation for a Generator Interconnection request. Because of this, the Customer may be required by the Transmission Provider to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Transient stability and short circuit analysis was not performed for this LOIS study.

Any changes to these assumptions, for example, one or more of the previously queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this LOIS at the expense of the Customer.

Nothing in this study should be construed as a guarantee of delivery or transmission service within Southwest Power Pool’s (SPP) transmission system. If the customer wishes to sell power from the facility, a separate request for transmission service must be requested on Southwest Power Pool’s OASIS by the Customer.