FILED
February 1, 2019
INDIANA UTILITY
REGULATORY COMMISSION

MISO DPP 2016 August Central Area Study Phase III Report

May 23, 2018

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TABLE OF CONTENTS

LIST OF TABLES

1. EXECUTIVE SUMMARY

This report presents the results of a System Impact Study (SIS) performed to re-evaluate the interconnection of the generators in the DPP 2016 August Central Area Phase III (Central Area DPP3). The study was performed under the direction of MISO and reviewed by an ad hoc study group. The ad hoc study group was formed to review the study scope, methodology, models and results. The ad hoc study group consisted of representatives from the interconnection customers and the following utility companies – Ameren, American Electric Power, Big Rivers Electric Corporation, City of Springfield (IL) Water Light & Power, Columbia (MO) Water and Light, Commonwealth Edison, Duke Energy Midwest, Hoosier Energy, Indianapolis Power & Light, MISO, Northern Indiana Public Service, PJM, Southern Illinois Power Cooperative, and Vectren.

1.1. PROJECT LIST

The original interconnection requests for DPP 2016 August Central Area had twelve (12) generation projects. Project J649 was withdrawn at the beginning of Phase I study, and based on Phase I study results (Decision Point I), three projects J573, J595, and J642 were withdrawn from the current study cycle. The output of J446 was reduced to 145MW in NRIS and ERIS. The output of J641 was reduced to 111MW in NRIS and kept full 140MW in ERIS. Therefore, there are eight (8) generation projects with a combined nameplate rating of 1260.05MW (ERIS) / 1231.05 MW (NRIS). The detailed list of Central Area DPP3 is shown in Table 1- 1, and the Phase III study was kicked off on January 18th, 2018.

Table 1-1 List of DPP August 2016 Central Area Phase III Projects

Project	Fuel Type	TO	County	State	Service Requested	MW	POI
J446	Wind	DEI	Clinton	IN	NRIS	145	Frankfort-New London 230 kV
J456	Wind	AMRN	McDonough	IL	NRIS	150	Niota-Macomb Northeast 138 kV
J474	Wind	AMRN	DeWitt	IL	NRIS	144	Tabor 138 kV
J513	Wind	NIPSCO	White	IN	NRIS	100.05	Reynolds 138 kV
J641	Solar	AMRN	Morgan, Scott	IL	NRIS	140(ERIS) 111(NRIS)	Meredosia East - Jacksonville Industrial Park 138 kV
J643	Solar	NIPSCO	Jasper	IL	NRIS	175	RM Schahfer-Starke 138 kV
J644	Solar	AMRN	Greene, Scott	IL	NRIS	110	Jerseyville Northwest 138 kV
J648	Gas	CE	Cook	IL	External NRIS	296	SCEP switchyard 138 kV

1.2. TOTAL NETWORK UPGRADES

The cost allocation of Network Upgrades for the projects in the DPP 2016 August Central Cycle Phase II reflects responsibilities for mitigating system impacts. The total cost of network upgrades is listed in Table 1-2 as shown below. The costs for Network Upgrades are planning level estimates and subject to be revised in the facility studies.

Table 1-2 Total Cost of Network Upgrades for DPP 2016 August Central Phase III Projects

Project	ERIS Network Upgrades ($)				NRIS Network Upgrades ($)	Interconnection Facilities ($)		Shared Network Upgrade ($)	Total Cost (TOIF not included) ($)
	Steady State	Stability	Short Circuit	Affected System	Deliverability	TO Network Upgrades	TO - Owned Direct Assigned		
J446	$0	$0	$0	$0	$0	$8,521,252	NA	$0	$0
J456	$0	$0	$0	$0	$0	$5,592,000	$524,000	$0	$0
J474	$0	$0	$0	$0	$0	$0	$524,000	$0	$0
J513	$0	$0	$0	$0	$0	$8,133,276	NA	$0	$0
J641	$0	$0	$0	$0	$0	$5,941,000	$524,000	$0	$0
J643	$0	$0	$0	$0	$0	$8,993,010	NA	$0	$0
J644	$0	$0	$0	$0	$0	$378,000	$524,000	$0	$0
J648	$0	$0	$0	$0	$0	$0	NA	$0	$0

2. ERIS ANALYSIS

2.1. J446, J513, J643 AND J648 SYSTEM IMPACT STUDY

J446, J513, J643 and J648 system impact study were performed by ABB under the direction of MISO and ad hoc group to identify network upgrades required to interconnect those requests in the DPP 2016 August Central Area group to the transmission system. System constrains were identified and the planning level cost estimates for the network upgrade are shown in Table 2-1. The detailed study report is listed in Appendix A.

Table 2-1 Planning Level Cost Estimation

Project	ERIS Network Upgrades ($)			Interconnection Facilities ($)		Total Cost (TOIF not included) ($)
	Steady State	Stability	Short Circuit	TO Network Upgrades	TO - Owned Direct Assigned	
J446	$0	$0	$0	$8,521,252	NA	$0
J513	$0	$0	$0	$8,133,276	NA	$0
J643	$0	$0	$0	$8,993,010	NA	$0
J648	$0	$0	$0	$0	NA	$0

2.2. J456, J474, J641 AND J644 SYSTEM IMPACT STUDY

J456, J474, J641 and J644 system impact study was performed by Ameren under the direction of MISO and ad hoc group to identify network upgrades required to interconnect those requests in the DPP 2016 August Central Area group to the transmission system. The required system upgrades are identified in the analysis and the planning level cost estimates are shown in Table 2-2. The detailed study report is listed in Appendix B.

Table 2-2 Planning Level Cost Estimation

Project	ERIS Network Upgrades ($)			Interconnection Facilities ($)		Total Cost (TOIF not included) ($)
	Steady State	Stability	Short Circuit	TO Network Upgrades	TO - Owned Direct Assigned	
J456	$0	$0	$0	$5,592,000	$524,000	$0
J474	$0	$0	$0	$0	$524,000	$0
J641	$0	$0	$0	$5,941,000	$524,000	$0
J644	$0	$0	$0	$378,000	$524,000	$0

2.3. AFFECTED SYSTEM IMPACT STUDY

J446

No mitigations were found to be required.

J456

If J456 goes into service prior to PJM Network Upgrade B2732.1, which has an in-service date of June 2019, an interim study by PJM would be required to address overloads of AB1-122 – Kendall 345 kV and AB1-122 Tap – Dresden 345 kV lines.

J474

No mitigations were found to be required.

J513

No mitigations were found to be required.

J641

No mitigations were found to be required.

J643

No mitigations were found to be required.

J644

No mitigations were found to be required.

J648

No mitigations were found to be required.

3. DELIVERABILITY ANALYSIS

3.1. INTRODUCTION

Generator interconnection requests have to pass Generator Deliverability Study to be granted Network Resource Interconnection Services (NRIS). If the generator is determined as not fully deliverable, the customer can either choose to elect the amount of NRIS available without upgrades or build system upgrades that will make the generator fully deliverable. Generator Deliverability Study ensures that the Network Resources, on an aggregate basis, can meet the MISO aggregate load requirements during system peak condition without getting bottled up.

MISO Generator Deliverability Study whitepaper describing the algorithm can be found at http://www.midwestmarket.org/publish/Document/3e2d0_106c60936d4_-767f0a48324a

3.2. DETERMINING THE MW RESTRICTION

If one facility is overloaded based on the assessed "severe yet credible dispatch" scenario described in the study methodology, and the generator under study is in the "Top 30 DF List" (see white paper for detail), part or all of its output is not deliverable. The restricted MW is calculated as following:

(MW restricted) = (worst loading – MW rating) / (generator sensitivity factor)

If the result is larger than the maximum output of the generator, 100% of this generator's output is not deliverable.

The generator is also responsible for any NEW base case (pre-shift) overload or NEW "severe yet credible dispatch overload" where the generator is not in the "Top 30 DF List", if the generator's DF is greater than 5%. Please see white paper for detail. The formula above also applies to these situations.

3.3. DELIVERABILITY STUDY RESULT

3.3.1. Deliverability Results Based on 2021 Summer Peak Case

J446

J446 is found 100% (145 MW) deliverable. Detailed study results are included in Table 3-1.

Table 3-1 J446 Deliverability Summary

J446 Deliverable (NRIS) Amount in 2021 Case: (Conditional on ERIS upgrades and case assumptions)	**145 MW (100%)**

J456

J456 is found 100% (150 MW) deliverable. Detailed study results are included in Table 3-2.

Table 3-2 J456 Deliverability Summary

J456 Deliverable (NRIS) Amount in 2021 Case: (Conditional on ERIS upgrades and case assumptions)	**150 MW (100%)**

J474

J474 is found 100% (144 MW) deliverable. Detailed study results are included in Table 3-3.

Table 3-3 J474 Deliverability Summary

J474Deliverable (NRIS) Amount in 2021 Case: (Conditional on ERIS upgrades and case assumptions)	**111 MW (100%)**

J513

J513 is found 100% (100.05 MW) deliverable. Detailed study results are included in Table 3-4.

Table 3-4 J513 Deliverability Summary

J513 Deliverable (NRIS) Amount in 2021 Case: (Conditional on ERIS upgrades and case assumptions)	**100.05 MW (100%)**

J641

J641 is found 100% (111 MW) deliverable. Detailed study results are included in Table 3-5.

Table 3-5 J641 Deliverability Summary

J641 Deliverable (NRIS) Amount in 2021 Case: (Conditional on ERIS upgrades and case assumptions)	**111 MW (100%)**

J643

J643 is found 100% (175 MW) deliverable. Detailed study results are included in Table 3-6.

Table 3-6 J643 Deliverability Summary

J643 Deliverable (NRIS) Amount in 2021 Case: (Conditional on ERIS upgrades and case assumptions)	**175 MW (100%)**

J644

J644 is found 100% (110 MW) deliverable. Detailed study results are included in Table 3-7.

Table 3-7 J644 Deliverability Summary

J644 Deliverable (NRIS) Amount in 2021 Case: (Conditional on ERIS upgrades and case assumptions)	**110 MW (100%)**

J648

J648 is found 100% (296 MW) deliverable. Detailed study results are included in Table 3-8.

Table 3-8 J648 Deliverability Summary

J648 Deliverable (NRIS) Amount in 2021 Case: (Conditional on ERIS upgrades and case assumptions)	**296 MW (100%)**

3.3.2. Deliverability Network Upgrades Summary

The cost estimate for proposed network upgrades is listed in Table 3-9.

Table 3-9 NRIS Constraints and Cost Estimate

Monitored Element	Mitigation	Planning Level Cost	Queue Projects with Impacts
None	None		

4. SHARED NETWORK UPGRADES ANALYSIS

Shared Network Upgrade (SNU) test for Network Upgrades driven by higher queued interconnection project was performed for this System Impact Study. No SNU were found for DPP August 2016 Central Area Projects.

5. COST ALLOCATION

The cost allocation of Network Upgrades for the study group reflects responsibilities for mitigating system impacts based on Interconnection Customer-elected level of Network Resource Interconnection service as of the draft System Impact Study report date.

5.1. COST ASSUMPTIONS FOR NETWORK UPGRADES

The cost estimate for each network upgrade identified in System Impact Study was provided by the corresponding transmission owning company.

5.2. COST ALLOCATION METHODOLOGY

The costs of Network Upgrades (NU) for a set of generation projects (one or more sub-groups or entire group with identified NU) are allocated based on the MW impact from each project on the constrained facilities in the Post Case.

Cost Allocation Methodology for Thermal Constraint

1. With all Group Study generation projects dispatched in the Post Case, all thermal constraints are identified.

2. Distribution factor from each project on each constraint is obtained.
3. For each thermal constraint, the maximum MW contribution (increasing flow) from each project is then calculated in the Post Case without any network upgrades.
4. For each thermal constraint, the cost estimates for one or a subset of NU are provided by the corresponding transmission owning company.
5. Then the cost of each NU is allocated based on the pro rata share of the MW contribution from each project on the constraints mitigated or partly mitigated by this NU. The methodology to determine the cost allocation of one NU is:

$$Project\ A\ cost\ portion\ of\ NU = Cost\ of\ NU * \frac{Max(Proj.\ A\ MW\ contribution\ on\ constraint)}{\sum_i Max(Proj.\ i\ MW\ contribution\ on\ constraint)}$$

6. The total NU costs for each project are calculated if more than one NU is required.

APPENDIX A – ABB System Impact Study Report

APPENDIX B – Ameren System Impact Study Report

APPENDIX C – Ameren Stability Report

APPENDIX D – PJM Affected Systems Study Thermal Report

APPENDIX E – PJM Affected Systems Study Stability Report