DPNS-2023-OCTOBER-1856

Delivery Point Network Study

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By SPP Engineering, Transmission Services

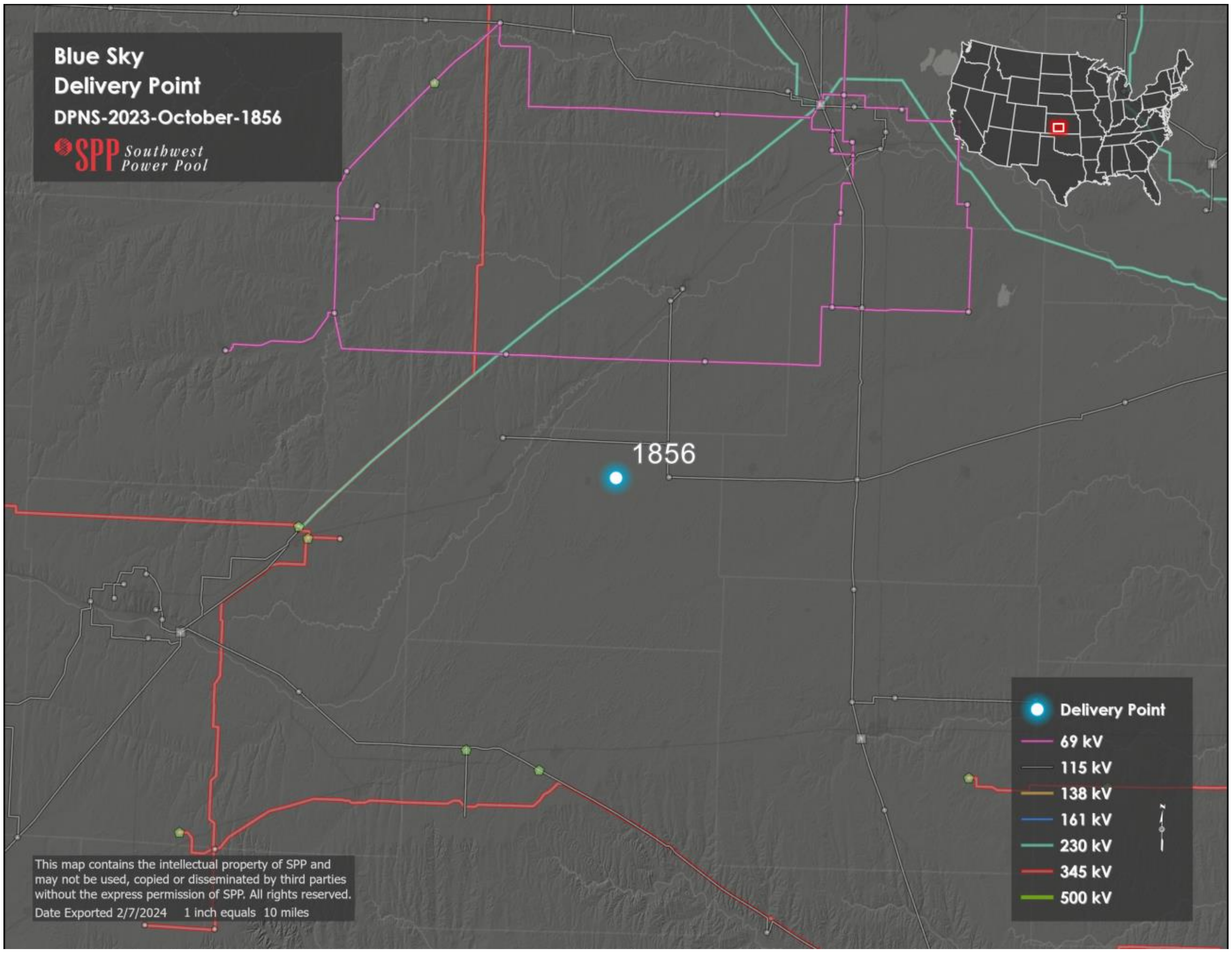
REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
2/9/2024	SPP	Original	Stability section will be completed at a later date.
4/5/2024	SPP	Updated Stability section	
4/29/2024	SPP	Updated the recommended project	

CONTENTS

SECTION 1: INTRODUCTION

This report outlines the results of an evaluation of regional transmission impacts from delivery point request DPNS-2023-October-1856. The requesting entity plans to add a new delivery point called Blue Sky. The Blue Sky delivery point is in the Midwest Energy (MIDW) transmission system.



The load flow models used for the evaluation were 2023 ITP models. SPP performed an AC contingency analysis on these models using PSS®E.

SECTION 2: STUDY METHODOLOGY

OBJECTIVE

The purpose of this study was to determine the regional transmission system impacts within the SPP footprint due to the new load served by MIDW. SPP performed a Delivery Point Network Study ("DPNS") with the configurations shown in Table 2-1 below.

STUDY PROCESS

- Model Assumptions
    - 2023 ITP models
        - Model years 2024, 2027, and 2032
            - Summer Peak (2027S and 2032S), Winter Peak (2024W, 2027W, and 2032W), and Light Load (2027L and 2032L)
    - 2023 ITP Short Circuit model set
        - 2027 Summer Max Fault
    - 2024 TPL Dynamic model set
        - 2025 and 2033 MDWG Summer Peak Base and Change Cases

Case Name	Study Year	Season	Scenario	Load (MW/MVAR)
2023ITPPF-24W.sav	2024	Winter Peak	Base Reliability	Base Case
2023ITPPF-27L.sav	2027	Light Load	Base Reliability	Base Case
2023ITPPF-27S.sav	2027	Summer Peak	Base Reliability	Base Case
2023ITPPF-27W.sav	2027	Winter Peak	Base Reliability	Base Case
2023ITPPF-32L.sav	2032	Light Load	Base Reliability	Base Case
2023ITPPF-32S.sav	2032	Summer Peak	Base Reliability	Base Case
2023ITPPF-32W.sav	2032	Winter Peak	Base Reliability	Base Case
2023ITPPF-24W_1856.sav	2024	Winter Peak	Base Reliability	Blue Sky = 12.7/4.17
2023ITPPF-27L_1856.sav	2027	Light Load	Base Reliability	Blue Sky = 11.0/3.61
2023ITPPF-27S_1856.sav	2027	Summer Peak	Base Reliability	Blue Sky = 15.0/4.93
2023ITPPF-27W_1856.sav	2027	Winter Peak	Base Reliability	Blue Sky = 12.7/4.17
2023ITPPF-32L_1856.sav	2032	Light Load	Base Reliability	Blue Sky = 11.0/3.61
2023ITPPF-32S_1856.sav	2032	Summer Peak	Base Reliability	Blue Sky = 15.0/4.93
2023ITPPF-32W_1856.sav	2032	Winter Peak	Base Reliability	Blue Sky = 12.7/4.17

Table 2-1: Study Cases

- Steady State Analysis
    - Assumptions (consistent with the ITP analysis)
        - AC contingency analysis on all load flow models using PSS®E
        - Monitored Elements
            - SPP facilities 69 kV and above
            - First-tier companies 100 kV and above
        - Contingencies (consistent with the ITP analysis)
            - Provided for the ITP by SPP members and first-tier companies
        - Apply SPP Criteria and NERC reliability standards
    - Compare thermal overloads and voltage violations that occur with and without the Blue Sky delivery point to determine thermal overloads and voltage violations resulting from the load addition to the transmission system.
- Dynamics Analysis
    - Assumptions
        - 2024 TPL Dynamics Model Set
            - 2025 and 2033 MDWG Summer Peak Base and Change Cases
    - Analyses
        - Fast Fault Screening using POM Studio
- Short Circuit Analysis
    - Assumptions
        - Used 2023 Final ITP Short Circuit models (Max Fault)
            - Placed all available facilities in service
                - Generation
                - Transmission lines
                - Transformers
                - Buses
            - Short Circuit Output
                - Physical
            - Short Circuit Coordinates
                - Polar
            - Short Circuit Parameters
                - 3 Phase
            - FLAT – classical fault analysis conditions
    - Analyses
        - Three-phase fault

SECTION 3: RESULTS OF ANALYSIS

POTENTIAL THERMAL OVERLOADS AND VOLTAGE VIOLATIONS

The analysis identified potential voltage violations resulting from the new Blue Sky delivery point. Table 3-1 details the potential voltage violations resulting from the load addition.

Year	Season	Facility Name	Facility Voltage (kV)	Contingency Name	Voltage Maximum (pu)	Voltage Minimum (pu)	Bus Voltage (pu)
2027	Summer	PAWNEE 3	115	NINNESC3 - RVROAD 3 - 1	1.05	0.9	0.896
2027	Summer	LARNED3	115	NINNESC3 - RVROAD 3 - 1	1.05	0.9	0.895
2032	Summer	EDWARDS3	115	NINNESC3 - RVROAD 3 - 1	1.05	0.9	0.8949
2032	Summer	PAWN-ED3	115	NINNESC3 - RVROAD 3 - 1	1.05	0.9	0.89311
2032	Summer	PAWNEE 3	115	NINNESC3 - RVROAD 3 - 1	1.05	0.9	0.88237
2032	Summer	KINSLEY3	115	NINNESC3 - RVROAD 3 - 1	1.05	0.9	0.89681
2032	Summer	LARNED3	115	NINNESC3 - RVROAD 3 - 1	1.05	0.9	0.88127

Table 3-1: Potential Voltage Violations

SHORT CIRCUIT

SPP performed short circuit analysis for the 2027 Summer Peak with the new load addition. The analysis identified the currents as listed in Table 3-2.

Season	Model	Fault	Bus	Current(Amps)
27S	Max Fault	Three Phase	SEWARD 2 69	5,324
27S	Max Fault	Three Phase	EDWARDS3 11	2,361
27S	Max Fault	Three Phase	HUNTSVL3 11	4,055
27S	Max Fault	Three Phase	KINSLEY3 11	1,495
27S	Max Fault	Three Phase	PAWNEE 3 11	1,644
27S	Max Fault	Three Phase	PAWN-ED3 11	2,176
27S	Max Fault	Three Phase	ST JOHN3 11	5,088
27S	Max Fault	Three Phase	SWRD1 1 12	7,865
27S	Max Fault	Three Phase	SEWRDMW3 11	4,944
27S	Max Fault	Three Phase	LARNED3 11	1,586
27S	Max Fault	Three Phase	CENTENNIAL3 11	5,299
27S	Max Fault	Three Phase	ARKVAL 3 11	11,003
27S	Max Fault	Three Phase	ARKVALJ3 11	11,250
27S	Max Fault	Three Phase	CIRCLE 3 11	26,033
27S	Max Fault	Three Phase	SADLHRN3 11	4,481
27S	Max Fault	Three Phase	NINNESC3 11	4,397
27S	Max Fault	Three Phase	RVROAD 3 11	4,474
27S	Max Fault	Three Phase	GBENDTP3 11	7,673
27S	Max Fault	Three Phase	GRTBEND3 11	12,906
27S	Max Fault	Three Phase	SEWARD 3 11	5,569

Season	Model	Fault	Bus	Current(Amps)
27S	Max Fault	Three Phase	ST-JOHN3 11	5,088
27S	Max Fault	Three Phase	ETHNOL 3 11	3,478

Table 3-2: Short Circuit Results

STABILITY

SPP performed a Fast Fault Screening (FFS) for the base case and change case models. The change case models include the Center delivery point changes. The FFS was performed for the 2025 and 2033 Summer Peaks. There were no significant differences in the critical clearing times between the base and change cases. Therefore, a transient stability analysis is not required.

TRANSMISSION SOLUTIONS

The new load at Blue Sky causes potential voltage violations on the transmission system around the new load for the loss of the Ninnescah – River Road 115 kV line. The voltage violations appear on the 115 kV radial line from St. John to Larned. SPP looked at the options listed below to mitigate the violations in Table 3-1.

Solution #1: Seward – Pawnee 115 kV line (Total Cost: $ 14.6M)

- New 115 kV line from Seward – Pawnee (15.76 miles)
- Terminal Upgrades on Seward – Seward Tap 115 kV line (upgrade metering CT's)

Solution #2: Reactive Support at Kinsley (Total Cost: $ 0.5M)

- Add new 5 MVAR cap bank at Kinsley 115 kV sub
- Add additional 2.5 MVAR cap bank at Kinsley 115 kV sub (Year 10)

SPP chose to move forward with Solution #2. The 5 MVAR cap bank at Kinsley resolves the remaining low voltages in the area for the Year 5 models. The additional 2.5 MVAR cap bank is needed to solve the Year 10 low voltage issues. These upgrades alleviate all of the potential violations in Table 3-1 in the most cost-efficient manner.

New Upgrade Description*	Mileage	MVAR	Date Needed**	Estimated Cost***
Add new 5 MVAR cap bank at Kinsley 115 kV sub	-	5	1/1/2025	$355,383
Add additional 2.5 MVAR cap bank at Kinsley 115 kV sub	-	2.5	6/1/2031	$177,691
TOTAL NEW UPGRADE COST				**$533,074**

Table 3-3: Recommended Upgrades

*All requests with a Network Upgrade(s) identified in the DPNS will be subject to further evaluation in the soonest available Integrated Transmission Planning Assessment that is able to include the load changes, if it is determined that the Network Upgrade(s) will be able to meet the study timeframe requirements pursuant to the standardized project timelines in SPP Business Practices, based on the SPP determined Network Upgrade(s) need date. If it is determined that a Network Upgrade(s) identified from a DPNS is unable to be further evaluated pursuant to the Integrated Transmission Planning Assessment, the DPNS report will be posted on the SPP website once SPP is notified by the Transmission Customer to update the applicable Network Integration Transmission Service Agreement to reflect the changes in delivery points and the Network Upgrade(s).

Pursuant to Attachment AQ of the Tariff, the Transmission provider is responsible for assessing the impacts on the Transmission System caused by modifying an existing delivery point or establishing the new delivery point through the Delivery Point Network Study ("DPNS"). The DPNS may determine the need for a Network Upgrade(s) necessary for the modification of an existing delivery point or the establishment of a new delivery point. A Network Upgrade(s) that the Transmission Customer or Host Transmission Owner desires that exceeds the needed Network Upgrade(s) identified in the DPNS will need to be studied through the Transmission Provider's Sponsored Upgrade study process to evaluate the impacts of the desired changes on the Transmission System.

**If the project need date specified in this study cannot be met, the Transmission Owner will be required to submit mitigations pursuant to the SPP Project Tracking process. All upgrades or mitigations must be in place prior to the dates shown in Table 3-3.

***Note that the estimated new upgrade cost provided in this report is an SPP Conceptual Cost Estimate only; this is preliminary, and a more refined Study Cost Estimate will be developed after issuance of this report through a Standardized Cost Estimate Reporting Template (SCERT).

SECTION 4: CONCLUSION

The AC analysis revealed potential voltage violations associated with the Blue Sky load addition. The study shows that the following upgrades are required to reliably serve the load addition:

Add new 5 MVAR cap bank at Kinsley 115 kV sub
Add additional 2.5 MVAR cap bank at Kinsley 115 kV sub (Year 10)

The transmission upgrades in Table 3-3 are recommended to mitigate the voltage violations.