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C. Strategic Projects

Smart Valve Power Flow Control Device Installation at Eatonton Primary Substation

TEAMS 20466

Project Need Date: June 1, 2025

I. Executive Summary

The Smart Valve Installation project addresses thermal constraints on the Branch – Oasis 230kV and Eatonton Primary – Oasis 230kV lines associated with NERC TPL-001-5 planning event contingencies. The thermal constraints begin in 2024 and increase until the East Walton 500/230kV Area project is placed in service in 2027.

Operating guides (switching operations) could not be utilized to resolve the thermal constraints beyond 2025 due to the severity of the constraints. Installation of Smart Valve devices on the Branch – Oasis 230kV and Eatonton Primary – Oasis 230kV lines allows for optimized control of power flow on the lines under both normal and contingency conditions thus increasing reliability and resiliency of the transmission system in the area as shown in Figure 4.

Additionally, the installation of the Smart Valve non-wire alternative technology will provide valuable operational information as the Company looks to deploy similar technologies to assist with transmission system build out associated with Generation Fleet Transition (fossil retirement and increased renewables) along with Customer Choice projects.

This solution is the result of joint planning efforts amongst the GA ITS Participants.

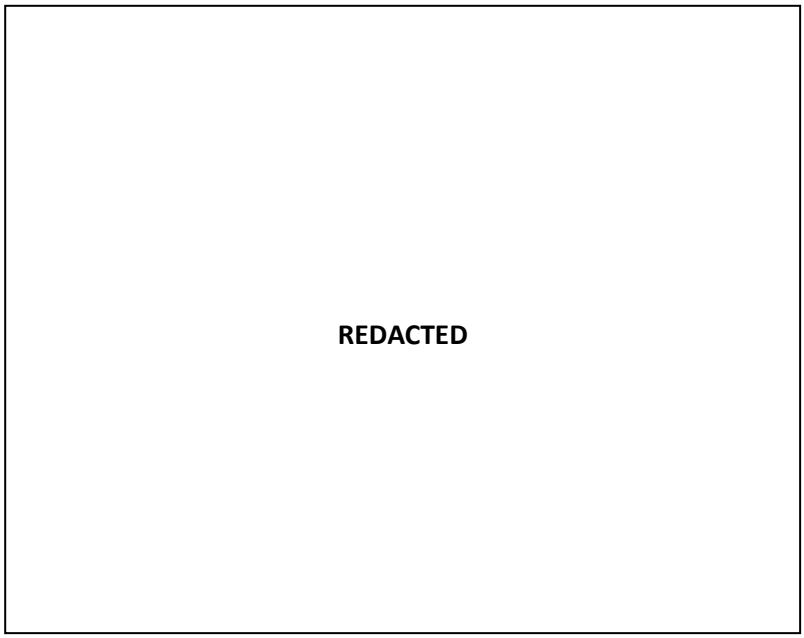


Figure 4 Area Transmission System

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II. Compliance Statement

This project addresses problems associated with Category P1 events. These problems were identified as part of Southern Company's Transmission Planning process in compliance with NERC Standard TPL-001-5.

III. Background and Problem Description

The transmission area contains several large industrial customers along with the Tiger Creek and Wallace Dam generation facilities. All this power flow causes that when one of the 230kV transmission lines is out of service, the other 230kV lines in the area overload. Five 230kV lines overload under contingency as shown in Figure 5:

- Eatonton Primary-Oasis 230kV
- Branch-Oasis 230kV
- Branch-Eatonton Primary #2 230kV
- Branch-Tiger Creek (Black) 230kV
- Branch-Tiger Creek (White) 230kV

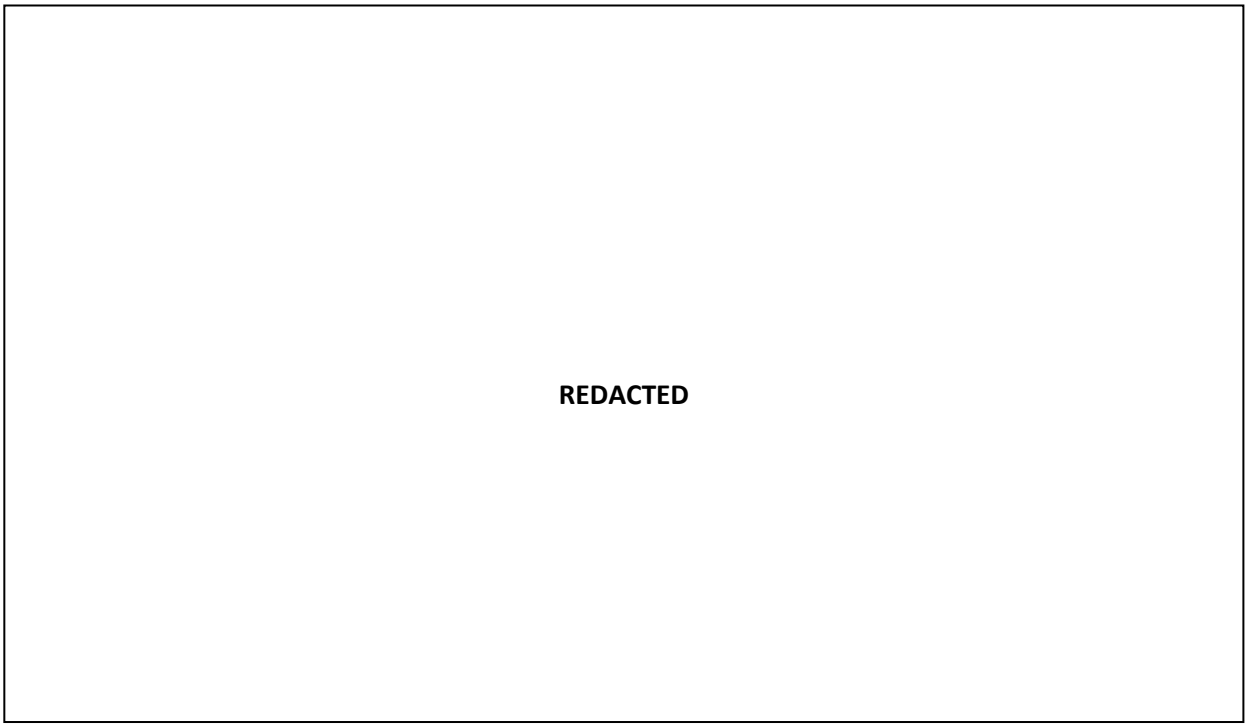


Figure 5 Transmission Area Constraints

Given the amount of thermal loading under contingency for the Branch-Oasis 230kV and the Eatonton Primary-Oasis 230kV transmission lines in 2025 and beyond, it is not possible to use operating guides to address the thermal constraints. The East Walton 500/230kV Area project will alleviate the thermal constraints on these lines when placed in-service by summer of 2027.

The thermal constraints on these lines start in 2024 and the loading increases as time passes as shown in Table 16. By 2025, the N-1 contingency thermal loading for the Branch – Oasis 230kV and Eatonton Primary – Oasis

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230kV lines becomes too high to utilize existing operating guides. The Smart Valve installation project will address issues on these line from 2025 to 2027.

YEAR	Thermal Loading Branch-Oasis 230kV	Thermal Loading Eatonton Primary-Oasis 230kV
2025	**REDACTED**	**REDACTED**
2026	**REDACTED**	**REDACTED**

Table 16: Thermal Overloads (v2 2023 Series)

The Smart Valve is a power flow control device designed and manufactured by Smart Wire. This is a modular Static Synchronous Series Compensator (SSSC) that injects a leading or lagging voltage in quadrature with the line current, thereby pulling power towards or pushing power away from the circuit on which they are installed.

IV. Study Assumptions

- Load Flow Cases: 2023 series V1 and V2
- Study Years: 2024 – 2033
- Case Seasons: Summer Peak, Off-Peak, Shoulder, Daylight Shoulder, and Hot Weather.
- The planned East Walton 500/230kV Area project remained in the cases with an in-service date of 2027.

V. Discussion of Alternatives

The Preferred Plan (REDACTED) consists of:

- Installation of Smart Valve devices on the Branch – Oasis 230kV and Eatonton Primary – Oasis 230kV lines at Eatonton Primary substation as illustrated in Figure 6.
- Extend the substation fence.
- Installation of communication equipment and integration with EMS.

The preferred plan will:

- Address the thermal overloads on the Eatonton Primary – Oasis 230kV and the Branch – Oasis 230kV transmission lines as shown in Table 17.
- Increase reliability and resiliency of the system since the Smart Valves are only in service for contingency conditions.
- Increases operational flexibility in the area.
- Provide for faster installation due to modular construction.

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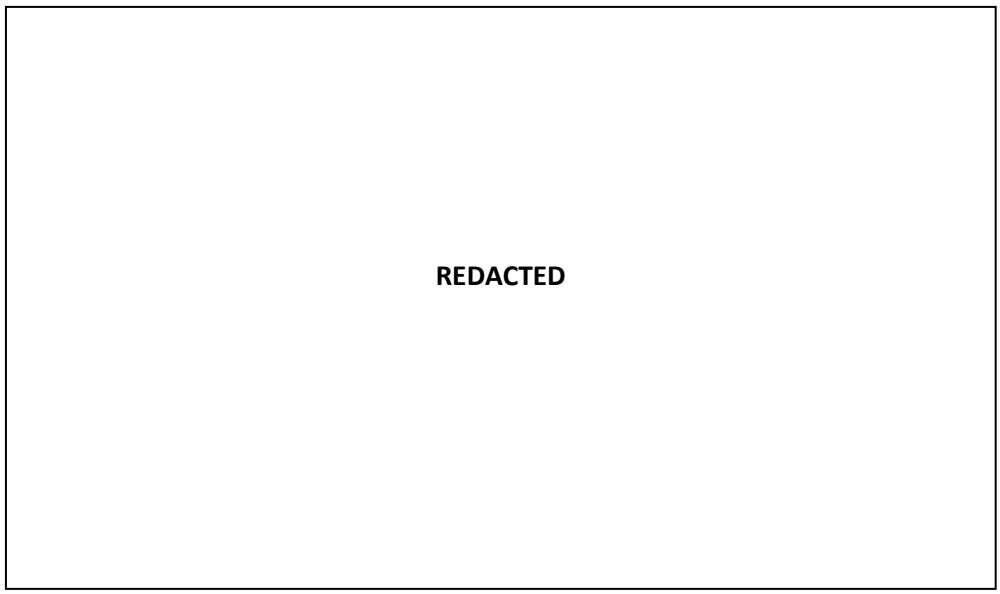


Figure 6 Smart Valve Installation at Eatonton Primary

Line Name	Rating (MVA)	Scenario	Years	
			2025	2026
Branch-Oasis 230kV	**REDACTED**	Base Case	**REDACTED**	**REDACTED**
		Smart Valve-10.58 ohms	**REDACTED**	**REDACTED**
Eatonton Primary-Oasis 230kV	**REDACTED**	Base Case	**REDACTED**	**REDACTED**
		Smart Valve-15.87ohms	**REDACTED**	**REDACTED**

Table 17 Transmission Line Loading

Alternate Plans

Alternate Plan 1: Do nothing ($0). This is not a viable option to remain in compliance with NERC TPL-001-5.

Alternate Plan 2: Installing 2% and 3% series reactors on the Eatonton Primary-Oasis 230kV and Branch-Oasis 230kV transmission lines (REDACTED). Table 18 provides the planning grade estimates series reactor installation.

Line Name	Planning Grade Estimate
Branch – Oasis 230kV line	**REDACTED**
Eatonton Primary – Oasis 230kV	**REDACTED**

Table 18 Series Reactor Planning Grade Estimate

With the Alternate Plan 2, the main concerns are:

- Obtaining and installing equipment by the compliance need date.
- Additional space required in substation to maintain required clearance due magnetic fields generated by series reactor.
- System losses created by reactors and lack of operational flexibility to allow for optimization of the lines under non-contingency conditions.

Alternate Plan 3: Direct rebuild of both the Branch – Oasis 230kV and Eatonton Primary – Oasis 230kV lines (REDACTED). Table 19 provides the planning grade estimates for rebuilding the transmission lines.

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Line Name	Length (miles)	Planning Grade Estimate
Branch – Oasis 230kV line	**REDACTED**	**REDACTED**
Eatonton Primary – Oasis 230kV	**REDACTED**	**REDACTED**

Table 19 Line Rebuild Planning Grade Estimates

With Alternate Plan 3, the main concerns are:

- Engineering and construction activities cannot be completed by the compliance need date of June 1, 2025.
- Accommodating the necessary outages to facilitate construction activities along with maintaining system reliability.

VI. Conclusion and Recommendations

The Preferred Plan was selected as the best investment of the labor and materials to solve the thermal constraints on the Branch – Oasis 230kV and Eatonton Primary – Oasis 230kV transmission lines. Although the Preferred Plan is not the least cost plan, it provides more flexibility, reliability, and resiliency to the transmission system. In addition, the project provides the opportunity to evaluate a non-wire alternative solution while obtaining valuable operational information for the future use of similar technologies.