Eastern Interconnection Planning Collaborative

Eastern Interconnection Planning Collaborative

Steady State Modeling and Load Flow Working Group

2023 Roll-Up Update and Heat Wave and Drought Scenario

Final Report

January 23, 2015

Eastern Interconnection Planning Collaborative

Executive Summary

This report is intended to be an amendment to the "Eastern Interconnection Planning Collaborative Steady State Modeling and Load Flow Working Group Report for 2018 and 2023 Roll-Up Integration Cases" which is publically available on the EIPC website[1]. This report details the EIPC Steady State Modeling and Load Flow Working Group's (SSMLFWG) 2014 effort to complete scenario analysis based on the Roll-Up Cases built in 2013. The scenarios were chosen following solicited input from Stakeholders. The SSMLFWG includes representatives from each NERC registered Planning Authority ("PA") that is a party to the EIPC Analysis Team Agreement.

Scenario A - Updated Base Case

This scenario was submitted by the New York PSC in order to capture the addition of significant enhancements by the NY Transmission Owners, referred to as the Transmission Owners' Transmission Solutions ("TOTS"), which are scheduled to be in operation in 2016.

While the driving force for this scenario was the NY TOTS Projects, all other PAs were asked to update the model with new, significant planning assumptions and projects that were approved since the 2013 report was issued. These updates are listed in Appendices F and G.

Interregional Transmission (Gap) Analysis

Once the 2023 Summer Peak Roll-Up Integration Case was updated with all significant transmission, generation, and/or load modifications, interregional transmission "gap" analysis was performed. The objective of the "gap" analysis was to identify potential power flow interactions that may have occurred from an interconnection-wide perspective due to the effects of the updated plans of one Planning Authority on another region. The interactions could be due to various types of updates by neighboring PA's such as new and/or reconductored transmission facilities, new load projections, new generation dispatch, etc. The "gap" analysis consisted of N-1 contingency analysis being performed on the updated case. For most Planning Authorities, there were no potential constraints identified. However, MISO, PJM, and TVA identified potential constraints and solutions. These identified potential constraints and solutions can be seen in Section 2.2 of the report.

Linear Transfer Analysis

The second type of analysis that was performed was a linear transfer analysis. The objective of this analysis was to demonstrate the effect the transmission, load, generation, etc., changes included in the updated 2023 Summer Peak Roll-Up Integration Case had on the ability to transfer power between large areas beyond the existing long term firm commitments between PAs already modeled in the case. Similar to the 2013 effort, the intent of this analysis was also to illustrate transfer capabilities of the transmission grid as currently planned (based on the updated 2023 Roll-Up Case) under a number of transfer patterns. The objective was not to identify projects to potentially increase transfer capability, but to demonstrate the transfer capability of the planned system. A comparison of the transfer capability results between the 2023 summer peak Roll-Up Case created as part of the 2013 effort versus the updated 2023 summer peak Roll-Up Case created as part of the 2014 effort can be seen in the following table.

[1] The 2013 EIPC report is available online: http://www.eipconline.com/uploads/FINAL_EIPC_Roll-up_Report_Feb14-2014.pdf

Source		Sink		Previous FCITC (MW)	Previous Lim. PA	New FCITC (MW)	New Lim. PA	Delta
A	FRCC	E	SERC	1600	DEF	1700	DEF	**100**
B	MISO	C	NPCC	3400	PENELEC-PJM	3100	PENELEC	**-300**
B	MISO	D	PJM	>5000	N/A	>5000	N/A	**0**
B	MISO	E	SERC	>5000	N/A	>5000	N/A	**0**
B	MISO	F	SPP	650	EES	650	EES	**0**
C	NPCC	B	MISO	1800	NYISO	1750	NYISO	**-50**
C	NPCC	D	PJM	1500	NYISO	1200	NYISO	**-300**
D	PJM	B	MISO	1600	ALTW-MISO	1650	ALTW	**50**
D	PJM	C	NPCC	2100	PENELEC-PJM	2850	NYISO	**750**
D	PJM	E	SERC	>5000	N/A	>5000	N/A	**0**
E	SERC	A	FRCC	1900	SBA/FRCC	1900	SBA/FRCC	**0**
E	SERC	B	MISO	>5000	N/A	>5000	N/A	**0**
E	SERC	D	PJM	1900	BREC-MISO	4800	DVP	**2900**
E	SERC	F	SPP	550	SWPA-SPP	500	SWPA-SPP	**-50**
F	SPP	B	MISO	850	WERE-SPP	800	WERE	**-50**
F	SPP	E	SERC	950	WERE-SPP	950	WERE	**0**

For most transfers, the transfer capability didn't change significantly; however, for transfers from SERC to PJM, the transfer capability increased substantially. The reason for this increase was due to local generation dispatch. Additional information about the linear transfer analysis can be found in Section 2.4.

Scenario B – Heat Wave and Drought

This scenario was submitted by the EISPC in order to identify impacted facilities in the event of a severe Heat Wave and Drought condition. Starting from the updated base case (Scenario A), the Heat Wave and Drought scenario was to be studied with the goal of answering the question, "*What constraints arise when large amounts of power are transferred to areas of need during times of extremely high temperatures and drought conditions?*" The importing "drought" area for the study is the southern half of the Eastern Interconnect.

In order to model these conditions, load in the sink region was scaled up approximately 5%, while generation in the sink region was scaled down approximately 5%. This created a total transfer to the drought region of about 30,000 MW. It should be stressed that the goal of the study was to identify constraints, and thus a level was chosen (30,000 MW) at which the study participants were confident constraints would be identified.

Heat Wave and Drought Scenario Analysis

A linear transfer analysis was performed on the Heat Wave and Drought scenario case. Since the objective of the transfer analysis was to identify facilities with greater than 100% thermal loadings, all voltage security limits were ignored. The Source and Sink areas utilized for the linear transfer are detailed below:

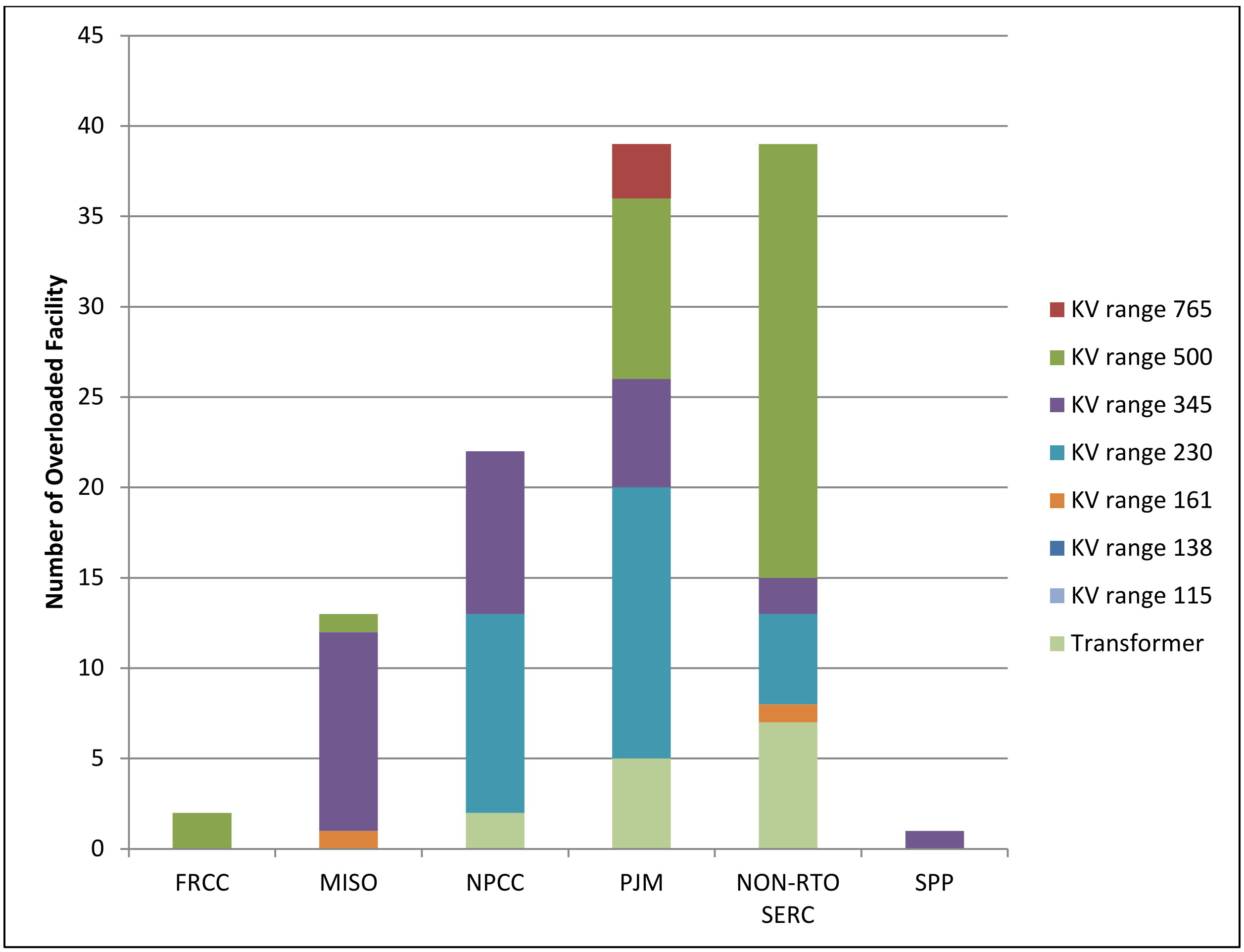
Transfer Source:

ISO-NE, NYISO, IESO, PJM, MISO North, ATC, LGE/KU, MAPP

Transfer Sink:

TVA, MISO South, SPP, SOCO, DEC, DEP, SCEG, SC, PS, Alcoa, EEI, FPL, DEF, JEA

As a result of the transfer analysis, multiple transmission facility overloads were identified. These constraints have been tabulated into the graph below, organized by region and facility KV rating:



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Eastern Interconnection Planning Collaborative

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Section 1 Introduction

This document explains the EIPC work performed in 2014. This effort is a continuation of the work completed in 2013, and as such, this report should not be considered to stand on its own, but is rather an extension of the 2013 report. For a detailed introduction to the EIPC and the Roll-Up Case development process please see the 2013 report[2].

The goal of the 2014 EIPC analysis was to build on the previous year's work, completing scenario analyses utilizing the Roll-Up cases developed in 2013. To this end, proposals for scenarios to be studied were solicited from stakeholders. Two sample proposals were made by EIPC, and five additional proposals were received from stakeholders.

Submitted by Stakeholders:

1. Heat Wave and Drought
    a. Submitted by: Eastern Interconnection States' Planning Council (EISPC)
    b. Study Case: 2023 Summer Peak
    c. General Description: Identify elements which limit significant power transfers to the Southeast United States as might be required during a time of extended drought and heat wave conditions.
2. Updated 2023 Summer Peak Roll-Up Integration Case
    a. Submitted by: New York PSC
    b. Study Case: 2023 Summer Peak
    c. General Description: Addition of NY Transmission Owner' Transmission Solution ("TOTS"). See below for details.
3. Indian Point Closed and Increased Gas Generation in Lower Hudson Valley
    a. Submitted by New York PSC
    b. Study Case: 2023 Summer Peak
    c. General Description: Indian Point closed, 1000 MW gas fired generation added in Lower Hudson Valley, increased gas fired generation in other regions
4. High Transmission Build-Out with Increased Canadian Hydro Import
    a. Submitted by: New York PSC
    b. Study Case: 2023 Summer Peak
    c. General Description: Add 1000 MW of increased transfer capability over UPNY/SENY interface, 1000 MW HVDC from Canada, increased transmission build-out in other regions
5. Other "at risk" generation scenarios (no details provided)

Other Scenarios Suggested by EIPC:

6. Inter-Regional Capabilities and Constraints during Winter Conditions
    a. Submitted by: EIPC as Sample Scenario 1
    b. Study Case: 2018 Winter Peak
    c. General Description: Assess EI's ability to transfer large amounts of power among regions of interest during winter peak conditions.
7. Inter-Regional Capabilities and Constraints during Spring Conditions

[2] The 2013 report is available online: http://www.eipconline.com/uploads/FINAL_EIPC_Roll-up_Report_Feb14-2014.pdf

a. Submitted by: EIPC as Sample Scenario 2
b. Study Case: 2018 Spring Peak
c. General Description: Assess EI's ability to transfer large amounts of power among regions of interest during spring peak conditions.

On March 25, 2014, the EIPC held an interconnection-wide webinar to discuss the scenario proposals and collect input to determine the ones that were a higher priority. The original scenario suggestions, input from stakeholders on the webinar, and resource availability to undertake the analysis and reporting needed were considered by EIPC.

Following consideration of Stakeholder input, the EIPC determined that the following scenarios would be evaluated by the EIPC SSMLFWG in 2014.

Scenario A – Updated base case for 2023

The first scenario selected for analysis was based on a proposal submitted by the New York PSC in order to capture the addition of significant enhancements by the NY Transmission Owners: Transmission Owners' Transmission Solutions ("TOTS"), which are scheduled to be in operation in 2016.

The projects are:

- Marcy South Series Compensation
- Fraser – Coopers Corners 345 kV Line Reconductoring
- Con Edison New 2nd Rock Tavern – Ramapo 345 kV Line
- Con Edison Staten Island Un-Bottling

Based on input from other stakeholders, this scenario was expanded to include an update of all modeling assumptions. Planning Authorities were asked to re-consider and update all assumptions that went into the original 2023 Roll-Up Case as they deemed significant. This included updates to generation, transmission, and load modifications. (See Appendices F and G)

It is expected that this updated model can then be used by study participants outside of the EIPC framework for other sensitivity studies of regional interest. Such studies might include additional generation changes or regional transmission build-outs.

Scenario B – Heat Wave and Drought Scenario for 2023

Starting from the updated base case (Scenario A), the Heat Wave and Drought scenario, submitted by EISPC, was developed with the goal of answering the question, "*What constraints arise when large amounts of power are transferred to areas of need during times of extremely high temperatures and drought conditions?*" The importing "drought" area for the study is the southern half of the Eastern Interconnect.

The following areas comprise the "Heat Wave and Drought" Sink region:
- Midcontinent Independent System Operator (South Region)
- Duke Energy Carolinas
- Duke Energy Progress

- South Carolina Electric and Gas
- Santee Cooper
- Southern Company
- Tennessee Valley Authority
- PowerSouth Energy Cooperative
- Alcoa Power Generating, Inc.
- Electric Energy Inc.
- Duke Energy Florida
- Florida Power & Light
- JEA
- Southwest Power Pool

The following areas comprise the Source region:

- ISO New England
- New York ISO
- Independent Electric System Operator
- PJM Interconnection
- Midcontinent Independent System Operator (North Region)
- American Transmission Company
- Louisville Gas and Electric/Kentucky Utilities
- Mid-Continent Area Power Pool

The Heat Wave and Drought condition was modeled by scaling both load and generation across the importing area's footprint. The load in the importing area was scaled up by approximately 5% (15,000 MW) to model increased load as a result of high heat. Generation across the importing area was scaled down by approximately 5% (15,000 MW) to model the effects of high heat (higher rejection temperatures result in lower thermal cycle efficiency) and/or limited cooling water. The result is a 30,000 MW import need within the sink region. Approximately 20,000 MW of the transfer was physically modeled within the case, while the final 10,000 MW was simulated utilizing a linear transfer. Generation in the source region was scaled up to meet the demands in the sink region. In the scaling of generation for both the source and the sink, it was assumed that all active units were available for dispatch.

The PSS MUST tool was used to complete the linear transfer analysis and determine significant facilities which would limit these transfers. Only facilities that responded to the transfer greater than 3% (OTDF) were identified.

Section 2 Scenario A

2.1 Model Updates

This section details assumptions made by each PA in updating the 2023 Roll-Up integration case, which was initially developed in 2013. Details regarding the initial development of the 2013 Roll-Up case are available in Section 2 of the 2013 report[3]. Updates include load forecasting, the treatment of demand resources and energy efficiency, interchanges with other systems, future transmission and generation project inclusion, and generation dispatch.

The following section describes the model updates represented in the 2014 series 2023 Roll-Up Integration Case for each EIPC Planning Authority. This includes such assumptions as demand, firm transactions/interchange, generation and transmission facilities. Additional details on transmission and generation changes are provided in Appendices F and G respectively.

Because the Roll-Up Integration Case is based upon current transmission plans as of 2014, the vintage of the data modeled is generally late 2013 or early 2014.

Alcoa Power Generating, Inc.
No changes were made to the 2023 Roll-Up case developed in 2013.

Duke Energy Carolinas
Duke Energy Carolinas is constructing a new 776 MW combined cycle unit at Lee with scheduled commercial operation in 2018. The plant and associated upgrades were added to the updated model.

Duke Energy Florida
No changes were made to the 2023 Roll-Up case developed in 2013.

Duke Energy Progress
No changes were made to the 2023 Roll-Up case developed in 2013.

Florida Power & Light
No changes were made to the 2023 Roll-Up case developed in 2013.

Georgia Transmission Corporation
GTC's information is included in the response from Southern Company. Please note that any transmission facilities listed under the PA "SBA" also include GTC transmission projects.

Independent Electricity System Operator
Load Forecasts and Growth Rates
The IESO, in conjunction with the Ontario Power Authority, produces load forecasts regularly. As of March 2014, the Ontario normal weather peak demand for Summer 2023 was forecasted to be 22,616 MW after deducting conservation and embedded generation. This increase in load reflects a net

[3] The 2013 EIPC report is available online: http://www.eipconline.com/uploads/FINAL_EIPC_Roll-up_Report_Feb14-2014.pdf

annualized 10 year growth rate of 0.1%. The normal weather scenario is based on historical weather from the past 31 years and represents typical weather on a monthly basis.

Firm Transactions
Transmission service is not sold in Ontario; transactions at the interties are scheduled based on economic merit through the energy market. If a transaction is successfully scheduled, it will be provided with access to the transmission system. Therefore, the IESO 2023 model has zero firm transactions.
IESO area interchange assumptions in the 2023 Roll-Up Integration Case includes a net import of 1,250 MW from Quebec on HVDC lines.

Future Transmission and Generation Projects
Ontario is proposing to develop or enhance network transmission facilities to accommodate renewable resources and new loads. Additional transmission development may be identified in the future when there are further developments on the resource options. Considering the 2023 Roll-Up case prepared for 2013 EIPC study as the starting point, there are no transmission changes.
Regarding generation changes, Ontario is planning to install more wind and solar generation by the year 2023. The exact locations are not yet known; instead the generation in the 2023 Roll-Up integration case was installed on a zonal basis.

ISO New England
The model of the 1200 MW Northern Pass HVDC Transmission Line from Quebec to New Hampshire was added to the 2023 Roll-Up case developed in 2013. ISO-NE's area interchange assumptions in the 2023 summer Roll-Up Integration Case include 3620 MW of imports and 0 MW of exports, resulting in a net interchange of -3620 MW.

JEA
No changes were made to the 2023 Roll-Up case developed in 2013.

LG&E and KU Energy
No changes were made to the 2023 Roll-Up case developed in 2013.

MAPPCOR
MAPPCOR submitted system modeling changes on behalf of the Mid-Continent Area Power Pool (MAPP) planning area. The updates provided represent the MAPP system as it had been modeled during the MAPP regional planning processes. The modeling updates represent new or updated projects presented in the 2013 MAPP Regional Plan, with expected in-service dates prior to the 2023 summer season. All modeling data for these projects were provided from the 2013 Series Midwest Reliability Organization (MRO) model set that has been fully reviewed during the 2014 MAPP regional processes.

MEAG Power
MEAG's information is included in the response from Southern Company. Please note that any transmission facilities listed under the PA "SBA" also include MEAG transmission projects.

Mid-Continent ISO (MISO)
Changes to Transmission Facilities: Updated ratings, impedances, as-built topology and transmission-to-distribution connections for the ATC areas. Changes to Generation: None

New York ISO

The New York State Public Service Commission (NYSPSC), in an Order issued November 30, 2012, directed Consolidated Edison (ConEdison) to work with the New York Power Authority (NYPA) to develop a contingency plan to address reliability concerns associated with the potential closure of the Indian Point Energy Center (IPEC) nuclear power plant. In response to the Order, ConEdison and NYPA jointly filed a proposal where ConEdison, NYPA, and New York State Electric and Gas (NYSEG) would pursue development of three Transmission Owner Transmission Solution (TOTS) projects:

1. Marcy South Series Compensation and Fraser – Coopers Corners 345 kV line reconductoring (NYPA and NYSEG)
2. New 2nd Rock Tavern – Ramapo 345 kV line (ConEdison)
3. Staten Island Un-bottling (ConEdison)

The NYSPSC issued an Order on November 4, 2013 accepting the proposed TOTS projects as the IPEC Reliability Contingency Plan. Since this Order was issued after the completion of the original 2023 Roll-Up Case and analysis, the NYSPSC proposed a scenario which included the TOTS projects as well as provided for Planning Authorities to include any other significant updates to the case.

PJM Interconnection

The 2023 Roll-Up power flow model contained the 2018 Regional Transmission Expansion Planning (RTEP) representation of PJM's topology, resources and 2013's peak load forecast for 2023. Since then, PJM has developed the model being used in the 2014 RTEP analysis. This 2019 RTEP (vintage 04/25/2014) model, which included topology changes and new/retired resources, was used in the update. The only additional modification to the 2019 RTEP model was the adjustment in the load levels to represent the year 2023. PJM used the 2014 load forecast to adjust the load to a 2023 peak load level of 178,579 MW. Appendix F contains a list of resources added to the model and Appendix G a list of significant topology additions (230kV and above) to the model.

PowerSouth Energy Cooperative

No changes were made to the 2023 Roll-Up case developed in 2013.

Santee Cooper

No changes were made to the 2023 Roll-Up case developed in 2013.

South Carolina Electric and Gas

Minor updates for generation and load scale were provided, but nothing of significance to the results of the case.

Southern Company

The Southern Balancing Authority model (Area 346) was replaced with the latest load forecast, generation resource, and transmission topology information available at the time of the updated Roll-Up Case creation.

Southwest Power Pool

No changes were made to the 2023 Roll-Up case developed in 2013.

Tennessee Valley Authority

Load Forecasts and Growth Rates

The load forecast used in the Roll-Up Integration Case used TVA's official February 2014 delivery point load forecast provided by TVA's Enterprise Planning group. This forecast is a coincident system summer peak forecast assuming normal weather patterns and a medium economic outlook. This load forecast is a 50/50 load projection; meaning there is a 50% chance that the actual load will be higher or lower than the forecast.

TVA's load forecast for summer peak 2014 is 32,500 MW. TVA's load forecast for summer peak 2023 is 35,533 MW. This reflects a 0.9% load growth over the next 9 years.

Interchange or Firm Transmission Service Modeled

TVA's area interchange assumptions in the 2023 summer Roll-Up Integration Case include 1013 MW of imports and 1114 MW of exports, resulting in a net interchange of 101 MW.

2.2 Interregional Transmission "Gap" Analysis

The Interregional Transmission Power Flow Analysis performed for this scenario is based upon the 2023 Roll-Up model, which represents power system facilities and loads for the summer peak conditions forecasted as developed by each Planning Authority during their then-current planning cycle. The Interchange utilized for this analysis is based upon a subset of transmission service commitments representing full path transactions from source to sink.

A contingency analysis was performed to identify potential power flow interactions from an interconnection-wide perspective that may result from the effects of plans of one Planning Authority on another region. Because this particular set of power flows and energy exchange (Interchange) may differ from those assessed during local and regional planning activities, it is possible that additional constraints may be identified. To the extent additional constraints or "Gaps" are identified during the interregional analysis, these constraints and the accompanying power flow conditions will be referred to the respective regional planning processes of the PAs.

This task is a screening analysis and its results (potential gaps) will be referred to the regional planning processes of the Planning Authorities for detailed assessments. Detailed analysis may or may not indicate a need for system upgrades in future planning cycles.

This analysis is meant to be identical to the analytical process that was carried out in 2013. The same procedure was followed so that differences in the results could be attributed solely to updates in the model rather than study methodology.

2.2.1 Contingency Selection and Thermal Criteria

System performance was assessed in a manner consistent with the NERC TPL reliability standards as described in Section V.D. of the "Steady State Modeling Load-Flow Working Group Procedure Manual". Bulk Electric System elements above 100 kV were monitored. Thermal criteria applicable to each facility was applied.

As described in the "Steady State Modeling Load-Flow Working Group Procedure Manual", Section V.C., contingencies representing outages of all transmission elements 230 kV and above and all transformers with a low-side voltage rating of 110 kV or above were studied. Planning Authorities were also given discretion to simulate contingencies of transmission elements below 230 kV depending upon the composition and characteristics of each PA's bulk electric system.

The intent of the "gap" analysis was to determine the effect of the significant updates on neighboring PA's. The voltage violations identified as part of the 2013 study were all found to be local in nature and therefore the voltage violations were not re-studied in 2014.

2.2.2 Interregional Transmission "Gap" Analysis Results

In this section, each Planning Authority provides a list of the constraining facilities that were identified as a result of the "Gap" analysis. It is assumed that the constraints identified are the result of neighboring system interactions that have yet to be assessed in detail. In some cases, a potential reliability issue may be difficult to pinpoint as to its cause with respect to system interactions. Issues identified will be utilized to inform the regional planning processes of the Planning Authorities in future planning cycles (See Section 2.3, Enhancements).

Summary of Thermal Results:

Mid-Continent ISO

Limiting Element	Rating (MVA)	Thermal Loadings (%)	Contingency	Comments
667001 HENDAY 4 230 667012 LONGSPR4 230 1-4	348.6	110.7	667001 HENDAY 4 230 667012 LONGSPR4 230 1-4	Local dispatch issue
667224 RAD_K1_6 138 667231 RADSNDC6 138 1	125	191.7	Base Case	Local dispatch issue

PJM Interconnection

Limiting Element	Rating (MVA)	Thermal Loadings (%)	Contingency	Comments
204515 27YORKANA 230 207922 BRIS 230 1	624	105.3	200004 CNASTONE 500 200013 PEACHBTM 500 1	Local load growth issue
220961 NWEST326 230 220963 CONASTON 230 1	874	100.8	220962 NWEST311 230 220963 CONASTON 230 1	Local load growth issue
238541 02AS Q-1 138 238645 02CW TP1 138 1	215	101.7	238551 02AVON 345 238850 02JUNIPE 345 1	Local load growth issue
238915 02LRN Q2 138 239728 02BLKRVR 138 1	270	123.7	238551 02AVON 345 238552 02AVON 138 92	Upgrade B2559
271227 CC HILLS ;RT138 271981 MATTESON ; R138 1	264	106.4	270729 E FRANKFO; R345 270767 GOODINGS ;1R345 1	Local load growth issue

Tennessee Valley Authority

Limiting Element	Rating (MVA)	Thermal Loadings (%)	Contingency	Comments
360370 5SHUQUALAK 161 361056 5S MACON MS 161 1	298.7	100.3	360241 5DEKALB MS 161 361671 5CLEVLAND MS161 1	Local Load Growth Issue
360294 5HUNTSVL AL 161 360656 5MADISON #2 161 1	289.5	100.6	360061 5MADISON #1 161 360294 5HUNTSVL AL 161 1	Local Load Growth Issue
360241 5DEKALB MS 161 361671 5CLEVLAND MS161 1	299.2	101.1	360241 5DEKALB MS 161 360370 5SHUQUALAK 161 1	Local Load Growth Issue
360241 5DEKALB MS 161 360370 5SHUQUALAK 161 1	298.7	102.6	360241 5DEKALB MS 161 361671 5CLEVLAND MS161 1	Local Load Growth Issue
360344 5WCOOKEVL TN161 361372 5S COOKEVLLE161 1	209.4	102.8	360347 5CORDELL HP 161 360506 5BAXTER TN 161 1	Local Load Growth Issue
360678 5SHELBY MEM1161 365573 5BOL HUSE 75161 1	334.1	103.5	360029 5SHELBY#2 TN161 360679 5SHELBY MEM2161 Z1	Local Load Growth Issue
360038 5JVILLE FP#1161 360305 5MT PLEAS TN161 1	208.3	104.0	360038 5JVILLE FP#1161 361028 5DRY CREEK T161 1	Local Load Growth Issue
360547 5GALLATIN F2161 360570 5CAIRO BEND 161 1	371.4	105.1	360351 5GALLATN PRI161 360547 5GALLATIN F2161 1	Local Load Growth Issue
360061 5MADISON #1 161 360294 5HUNTSVL AL 161 1	289.5	111.2	360281 5LIMESTONE 161 361637 5CTY LINE RD161 1	Local Load Growth Issue

All other areas had no thermal limits to report.

2.3 Enhancements

After Planning Authorities performed analysis on the 2023 Roll-Up Case to determine potential "gaps", conceptual upgrades were identified to address these thermal overloads so that the respective regional planning processes could be informed for future planning cycles. This section lists the issues identified by each PA in Section 3, together with high-level conceptual upgrades and the entities with which the PA will be coordinating on solutions in future planning cycles.

Mid-Continent ISO (MISO)

Two thermal facility issues were identified which meet the reporting requirements of Section 2.2.1. If a branch was overloaded for multiple contingencies, the highest overload was listed. There were other issues identified, however, a majority of the events have previously identified mitigations plans which were not modeled in the case. The items listed above are local generation issues internal to MISO.

PJM Interconnection

The EIPC contingency analysis resulted in five potential overloads in the PJM footprint. One of these overloads (Lorain – Black River 138kV) was observed in the 2019 RTEP analysis as well. An upgrade (B2559) consisting of re-building the transmission line with higher rating conductor, has been developed to alleviate the overload.

The other four potential overloads have not yet been observed in any of PJM's regional studies. PJM sees these overloads as local issues that could be related to load growth or dispatch. At this time PJM has not planned any upgrades for these facilities, but will examine these violations closely in its Regional Planning Cycle (RTEP).

TVA Interconnection

Contingency analysis for single branch events in TVA resulted in nine potential overloads, all of which met the reporting requirements of Section 2.2.1. All of the facilities that were identified through this analysis are a result of local load growth issues internal to TVA.

2.4 Linear Transfer Analysis

As in the 2013 work effort, linear transfer analysis was performed to demonstrate the effect the transmission, load, generation, etc., changes included in the updated 2023 Summer Peak Roll-Up Integration Case had on the ability to transfer power between large areas beyond the existing long term firm commitments between PAs already modeled in the case. The goal was to compare results with those developed last year to understand the impact of system upgrades. To keep the results comparable, the process and methodology for completing the transfers was identical to that conducted in the 2013 work effort. Details about the linear transfer analysis of the 2013 Roll-Up case are available in section 5 of 2013 report[4].

2.4.1 Linear Transfer Analysis Inputs & Process

Linear transfer power flow analysis input files (monitored elements, subsystems, and contingency files) were supplied by each PA to match their updated models as needed.

All facilities greater than 100 kV in the base case model were monitored. Generally, single contingency events for all facilities 161 kV and above in the base case model were assessed, including generators as appropriate. Known, approved, and applicable operating procedures were included in the contingency files.

The linear analysis was performed following an identical process as was performed in the 2013 work effort.

2.4.2 Linear Transfer Analysis Results

Table 1 describes the PAs that were grouped together for transfers as an area while Table 2 describes the combinations of areas [exporting (source) or importing (sink)] for which transfers were performed. For example, Group A includes FPL, JEA, and DEF in associated transfers performed. Note that while all bulk power facilities in the Eastern Interconnect were included in the power flow model, for this analysis participation in an area is limited to PAs that are parties to the EIPC.

[4] The 2013 EIPC report is available online: http://www.eipconline.com/uploads/FINAL_EIPC_Roll-up_Report_Feb14-2014.pdf

Table 1: Groupings of Planning Areas for Transfers

A	B	C	D	E	F
FPL	MAPPCOR	NYISO	PJM	DEC	SPP
JEA	MISO	ISO-NE		DEP	
DEF	ATC	IESO		LGE/KU	
	ITC	NBSO		GTC	
				PS	
				SCEG	
				SC	
				SOCO	
				MEAG	
				Alcoa	
				TVA	
				EEI	

Table 2: Transfers Performed

	Sink					
Source	**A**	**B**	**C**	**D**	**E**	**F**
A					Y	
B			Y	Y	Y	Y
C		Y		Y		
D		Y	Y		Y	
E	Y	Y		Y		Y
F		Y			Y	

Similar to the 2013 effort, the intent of this analysis was also to illustrate transfer capabilities of the transmission grid as currently planned (based on the updated 2023 Roll-Up Case) under a number of transfer patterns. The objective was not to identify projects to potentially increase transfer capability, but to demonstrate the transfer capability of the planned system. A comparison of the transfer capability results between the 2023 summer peak Roll-Up Case created as part of the 2013 effort versus the updated 2023 summer peak Roll-Up Case created as part of the 2014 effort can be seen in Table 3 below.

Table 3 below shows the FCITC limit identified for each transfer and the Planning Authority in which the limiting element resides. The table shows the FCITC value that was identified in last year's study ("Previous") as well as those values identified with for the updated case ("New"). The delta column shows the change from last year's results to the updated model. As can be seen, the majority of the transfer limits do not change significantly. The exception to that is the SERC to PJM transfer.

The limiting element to transfers from SERC to PJM is Benton-Cordova, which is a TVA facility. The main difference in this year's vs last year's 2023 Summer case was local generation dispatched.

The NY TOTS projects did not have a significant impact on transfer capability.

Table 3: Changes in Transfer Limits

		Previous		New		
Source	**Sink**	**FCITC (MW)**	**Lim. PA**	**FCITC (MW)**	**Lim. PA**	**Delta**
A FRCC	E SERC	1600	DEF	1700	DEF	**100**
B MISO	C NPCC	3400	PENELEC-PJM	3100	PENELEC	**-300**
B MISO	D PJM	>5000	N/A	>5000	N/A	**0**
B MISO	E SERC	>5000	N/A	>5000	N/A	**0**
B MISO	F SPP	650	EES	650	EES	**0**
C NPCC	B MISO	1800	NYISO	1750	NYISO	**-50**
C NPCC	D PJM	1500	NYISO	1200	NYISO	**-300**
D PJM	B MISO	1600	ALTW-MISO	1650	ALTW	**50**
D PJM	C NPCC	2100	PENELEC-PJM	2850	NYISO	**750**
D PJM	E SERC	>5000	N/A	>5000	N/A	**0**
E SERC	A FRCC	1900	SBA/FRCC	1900	SBA/FRCC	**0**
E SERC	B MISO	>5000	N/A	>5000	N/A	**0**
E SERC	D PJM	1900	BREC-MISO	4800	DVP	**2900**
E SERC	F SPP	550	SWPA-SPP	500	SWPA-SPP	**-50**
F SPP	B MISO	850	WERE-SPP	800	WERE	**-50**
F SPP	E SERC	950	WERE-SPP	950	WERE	**0**

Section 3 Scenario B

3.1 Heat Wave and Drought Scenario Inputs & Process

In order to create the type of transfer that was required for this Scenario, the entire Eastern Interconnection had to be divided into two sections, a Source and a Sink. The most logical way to divide the areas was to geographically divide the North from the South (see Figure 1 below). PJM was kept in the same area (Source) to reflect realistic operations (PJM would not export any energy until all internal load is served). MISO was split into North and South regions, with the North region (Source) being the traditional MISO footprint while MISO South (Entergy) is in the Sink region.

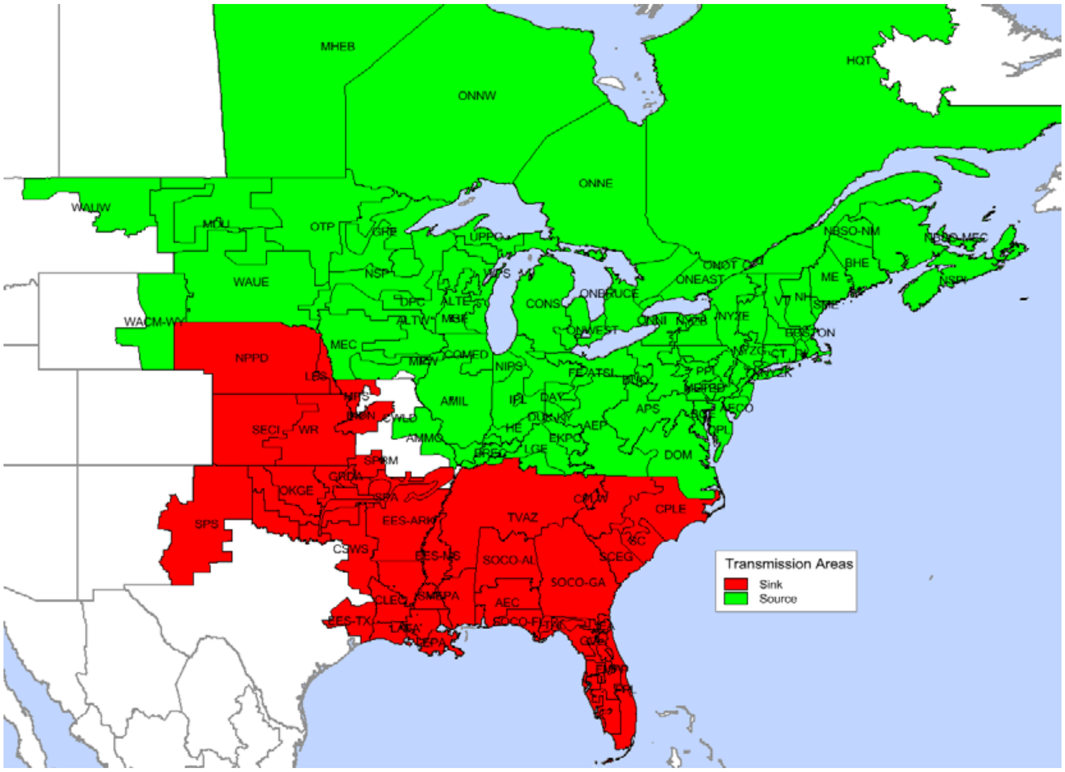
The following areas comprise the “Heat Wave and Drought” Sink region:

- Midcontinent Independent System Operator (South Region)
- Duke Energy Carolinas
- Duke Energy Progress
- South Carolina Electric and Gas
- Santee Cooper
- Southern Company
- Tennessee Valley Authority
- PowerSouth Energy Cooperative
- Alcoa Power Generating, Inc.
- Electric Energy Inc.
- Duke Energy Florida
- Florida Power & Light
- JEA
- Southwest Power Pool

The following areas comprise the Source region:

- ISO New England
- New York ISO
- Independent Electric System Operator
- PJM Interconnection
- Midcontinent Independent System Operator (North Region)
- American Transmission Company
- Louisville Gas and Electric/Kentucky Utilities
- Mid-Continent Area Power Pool

Figure 1 – Source and Sink Transmission Areas



Once the Source and Sink were defined, each area inside of these regions had to be assigned a participation factor (pf) so their generation and/or load could be scaled appropriately. The Source generation participation factor was determined by taking an individual balancing authority area's available generation divided by the total Source available generation. Available generation is defined as max MW output (Pmax) minus generating MW output (Pgen). Only generators that were in-service at a type 2 or type 3 bus were included. The Sink generation participation factor was determined by taking an individual balancing authority area's total generating MW output (Pgen) divided by the total Sink generating MW output. Again, only generators that were in-service at a type 2 or type 3 bus were included. The Sink load participation factor was determined by taking an individual balancing authority area's total load MW amount (Pload) and dividing it by the total Sink load MW amount. In all cases, generator limits were enforced, meaning a generator could not be scaled above its maximum MW output (Pmax) or below its minimum MW output (Pmin).

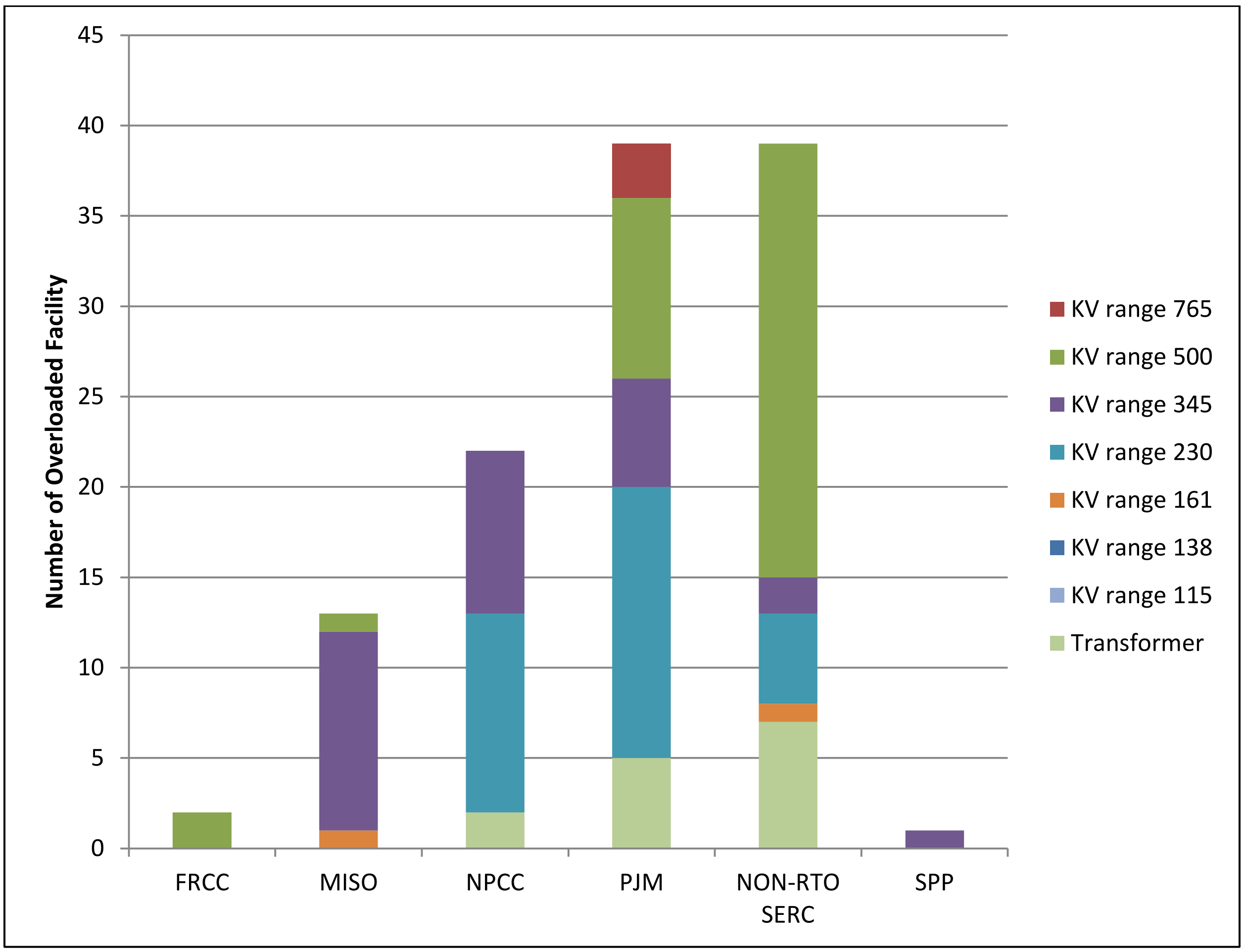
The Heat Wave and Drought condition was modeled by scaling both load and generation across the importing area's footprint. The load in the importing area was scaled up by approximately 5% (15,000 MW) to model increased load as a result of high heat. Generation across the importing area was scaled down by approximately 5% (15,000 MW) to model the effects of high heat (higher rejection temperatures result in lower thermal cycle efficiency) and/or limited cooling water. The result is a 30,000 MW import need within the sink region. Approximately 20,000 MW of the transfer was physically modeled within the case while the final 10,000 MW was simulated utilizing a linear transfer. In this scaling of generation it was assumed that all inactive units (type 4) were not available for dispatch. Generation in the source region was scaled up to meet the demands in the sink region.

3.2 Heat and Drought Scenario Analysis & Results

The PSS MUST tool was utilized to complete the linear transfer analysis. The method of analysis used was an N-1 contingency analysis on each 200 kV facility and above, with exception to areas where lower voltage levels are required. During the contingency analysis, all facilities 161 kV and above were monitored. Any facility with a 3% or greater OTDF was included in the results. The main intent of the transfer was to determine wide ranging transmission thermal constraints not previously identified system operating limits or voltage security constraints which would potentially be addressed if the transmission system was expanded to handle such a large transfer. Accordingly, the effect that the large amounts of transfer had on system operating limits or voltage security constraints was not considered for the purpose of this analysis.

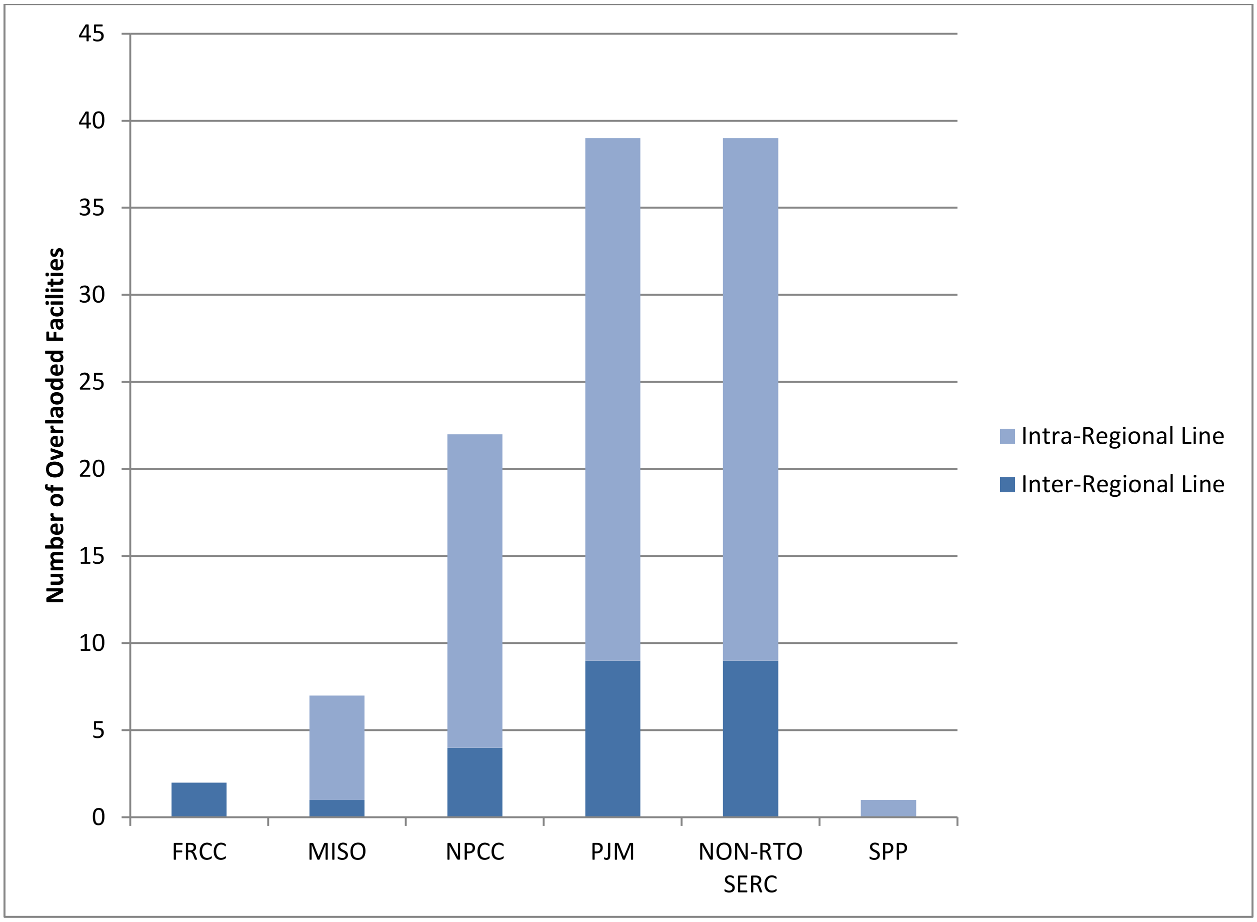
As a result of the transfer analysis, multiple transmission facility overloads were identified. As you can see in the chart below, the majority of the constraints identified are located in the SERC and PJM regions. This can be attributed to the fact that the majority of the load and generation resides in the eastern most half of the Eastern Interconnect.

Figure 2: Overloaded Facilities by Study Area and kV



Approximately 77% of the overloaded facilities were facilities internal to the regions, while the remaining 23% were tie lines between the 6 regions. The graph below details how this percentage breaks down between the regions:

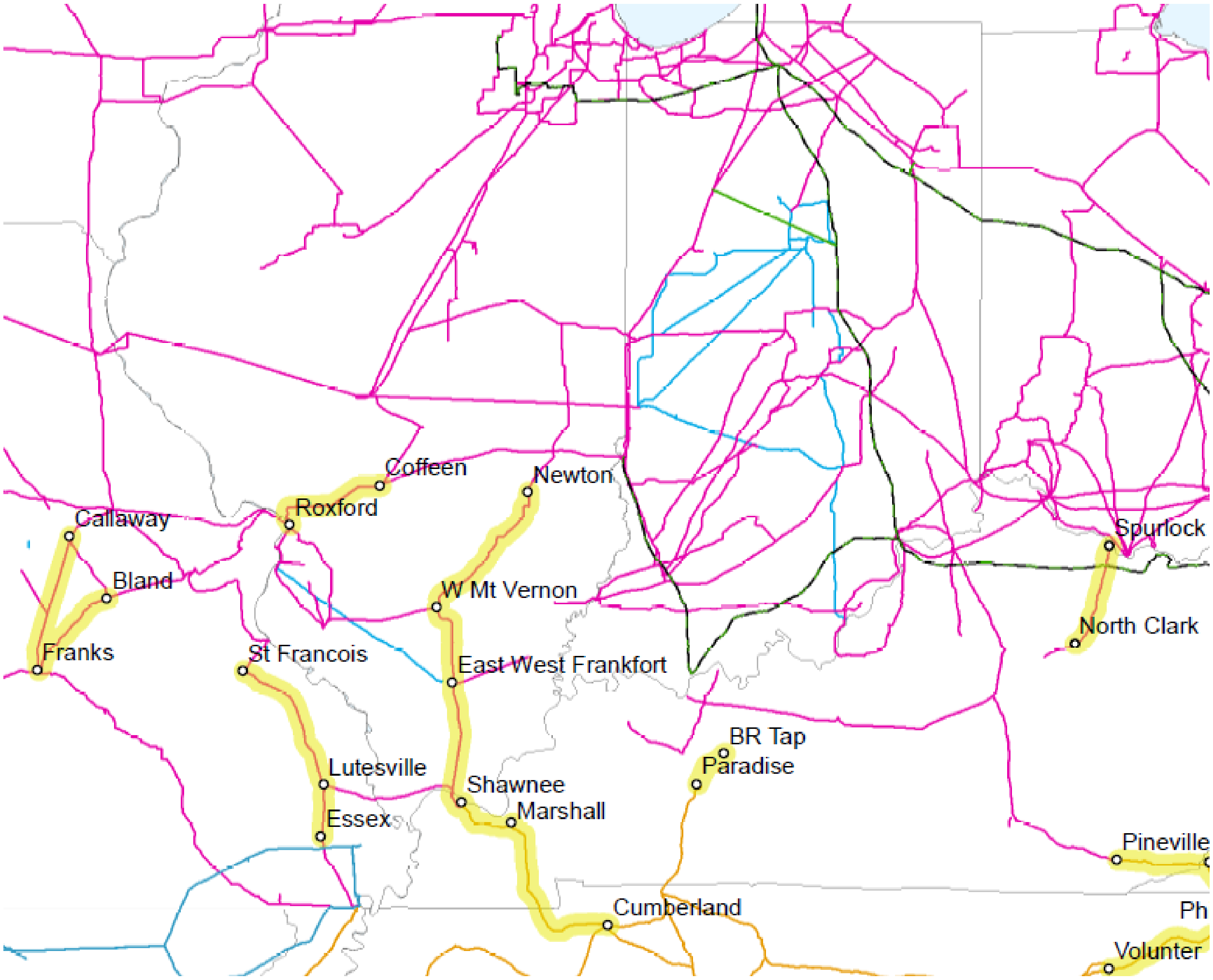
Figure 3: Overloaded facilities by Intra-Regional Facilities or Inter-Regional Ties



3.2.1 <u>Limiting Elements and Results Discussion</u>

As a result of the transfer analysis, multiple transmission facility constraints were identified. To present these results in a useful manner, the Eastern Interconnect map has been split up into five large areas depicted below. Within the five area maps, the impacted transmission facilities have been highlighted. The entire Eastern Interconnection map illustrating all constraints can be seen in Appendix K.

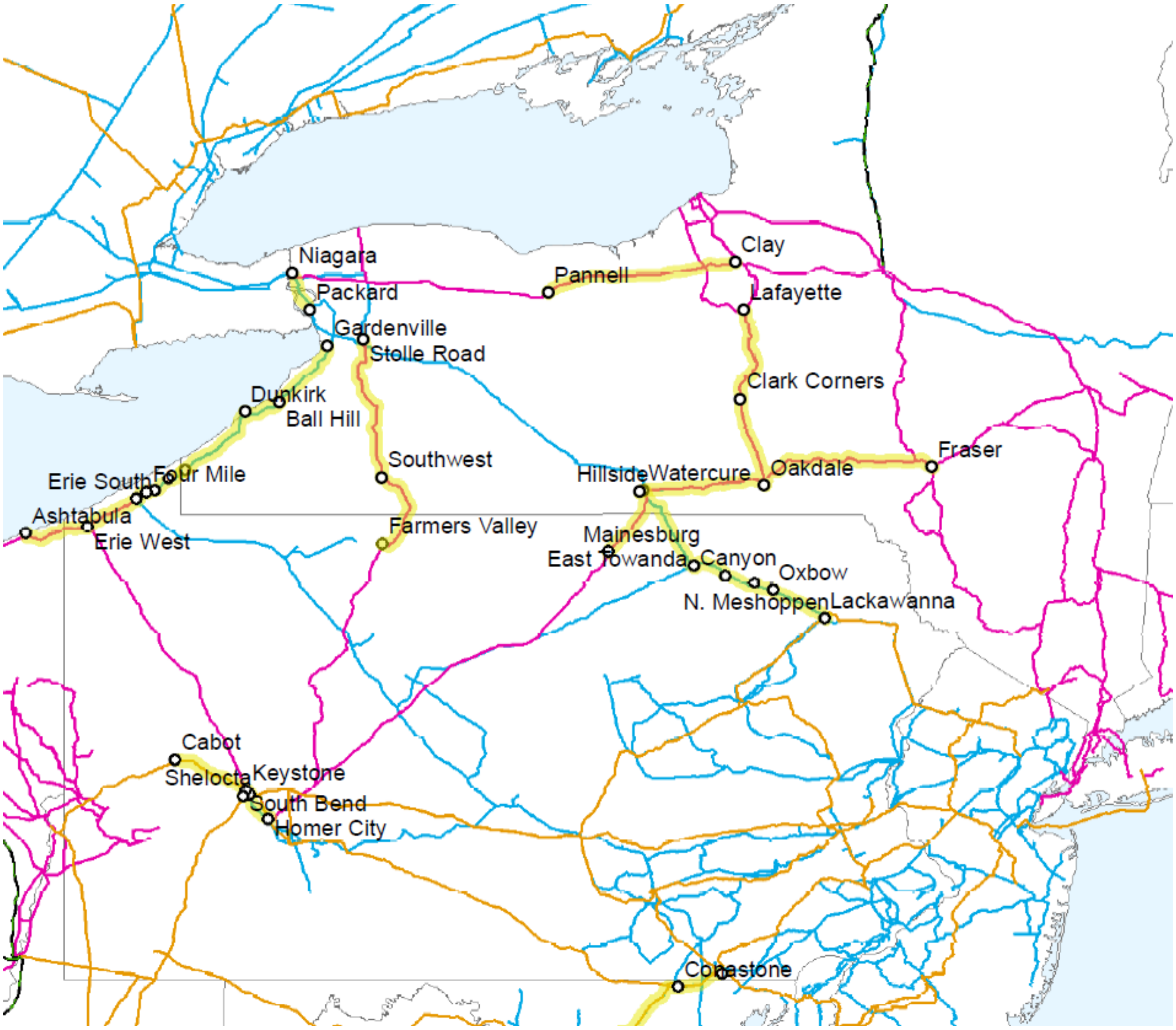
Map 1: Transmission Constraints Identified within MISO



Midcontinent Independent System Operator

Most of the transfer constraints in MISO were in Southern Illinois and Eastern Missouri near Saint Louis. In a heavily biased transfer case, these constraints are expected near the edge of the MISO border. To achieve the full transfer level and alleviate the constraints, significant transmission reinforcement would be needed along the MISO-AECI and MISO-TVA seams.

Map 2: Transmission Constraints Identified within NPCC



ISO New England

A 266 MW transfer from ISO New England Source Areas to the Sink Areas was modeled in the case. For ISO New England this was accomplished by scaling up the Source Generation to 356 MW while Load remained same. Then a 10,000 MW MUST transfer from the Source to Sink was performed on the case to screen out the low responding facilities and to analyze the system with up to ~30,000 MW transfer. No valid constraints were found for ISO New England.

New York ISO

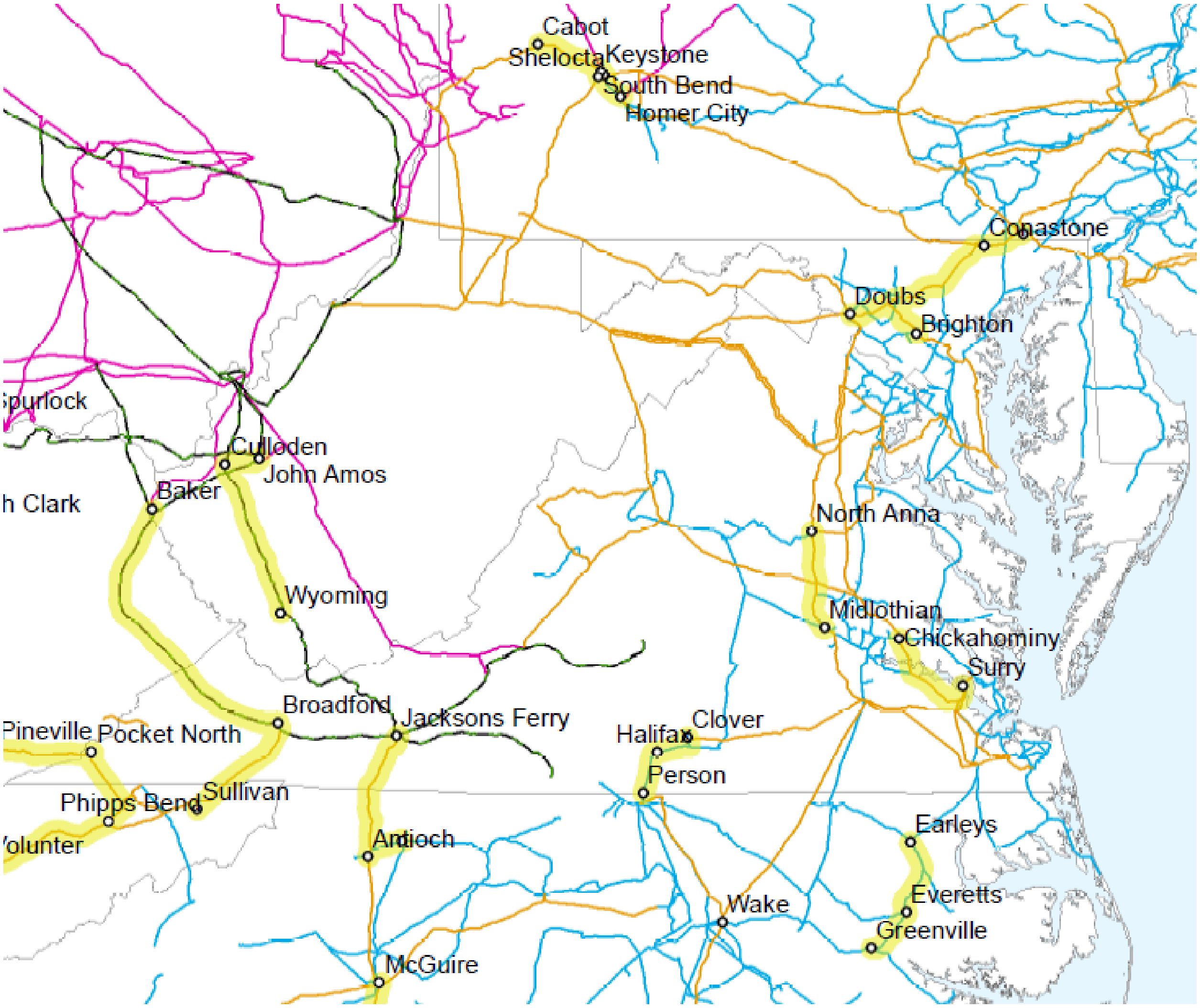
In the Scenario B Heat Wave and Drought Scenario, as part of the 20,000 MW modeled power flow transfer, the NYISO as a Source area is assigned 2134 MW to transfer to the Sink areas south of New

York. In order to provide the transfer assigned to NYISO, 2388 MW of generation in New York is scaled up.

The resulting thermal overloads from the power transfer in New York are highlighted in Map 2. In general, the overloaded lines are in series with major free-flowing ties between New York and PJM as the shift dictates power is transferred from NPCC to PJM to Sink areas in the southern states. Other lines that become overloaded are downstream of large generation sources in New York scaled up to accommodate the required transfer.

The western NY 230 kV path from Niagara south is constrained under present-day real-time high load conditions and the constraints are expectedly further exacerbated with the dramatic transfer applied in Scenario B. This is consistent with findings in both NYISO internal Planning and Operations studies where elements along this path are known to limit transfers in that area, as is the case in the results from Scenario A Updated Case.

Map 3: Transmission Constraints Identified within PJM



PJM Interconnection

The EIPC scenario B analysis comprised of studying a heat and drought scenario. The scope of this analysis specified the creation of a power flow case containing the modeled heat and drought condition. Due to difficulties in modeling this extreme condition (30 GW of transfers), the analysis was broken into two steps. The first 20 GW was physically modeled in the power flow case and the remaining 10 GW was simulated in a linear transfer analysis. PJM was assigned as a source area and for the 20 GW power flow case its generation was ramped up by 7,360 MW (7,029 MW to transfer to the sink areas and the remainder to accommodate increase in losses) of the peak level already modeled in the 2023 Rollup case. Similarly, areas North of PJM (also North of the sink areas) were scaled up by approximately 4,590 MW.

The majority of the flows prevailing from the North regions (NYISO, ISO-NE, IESO, etc) have no path other than to go through PJM's transmission system to reach the sink areas. In addition to these North areas transfers flowing through PJM, other areas' loop flow also used PJM's transmission system to reach the sink. These flows combined with the North flows and PJM's generation increase, reached approximately 16 GW above the level modeled in the Rollup case. PJM believes these external area flows are significant and have a great impact on the overloads observed in the results.

Results from the linear transfers analysis (full 30 GW) are shown in Map 4 above. Looking closely at the overloads shown in the map a flow path can be noticed. This flow path starts in the North borders of PJM going through some high loaded facilities in PJM to finally exit PJM's system through PJM's ties with southern regions. PJM believes these severely loaded facilities are resulting in great part from the North transfers flowing through an already highly loaded PJM transmission system.

Although it was not the intent of the study to find a suitable emergency limit that could be achieved with moderate operating adjustments and minor upgrades, PJM thought it would be important to include in the report at least an idea of such a transfer level. To this end, PJM performed additional sensitivity analysis and determined that anywhere from 5 GW to 7 GW could be achieved. This amount of transfer capability is more than adequate to accommodate PJM's obligations for emergency supply to adjacent regions. Therefore, PJM concludes the amount of generation ramped up in PJM (~7.4 GW) to supply the emergency condition created by the heat and drought scenario could probably be achieved with minor adjustments and/or upgrades. However, if/when superimposed with the transfers from the North regions, major transmission improvements would be necessary.

Map 4: Transmission Constraints Identified within SERC & FRCC

FRCC Utilities

See Southern Company's comments for, since the facilities identified were tie lines with Southern Company.

Southern Company (includes GTC and MEAG)

As one of the PA's included in the sink area for the Heat Wave and Drought scenario, the Southern Company system, which includes GTC and MEAG, was modified to import 4253 MW in addition to the firm interchange commitments already modeled in the power flow case. To model the effect of the Heat Wave and Drought condition on Southern Companies system, the load was scaled up 2104 MW and the generation was scaled down 2149 MW. In addition to the increased imports modeled to serve the load within Southern Company, 1192 MW flowed across the Southern Company system to serve the additional load serving need within the FRCC system which is radially fed from the Southern Company system.

These transfer amounts were physically modeled in the power flow case as part of the 20 GW Eastern Interconnect transfer while the remaining 10 GW transfer was simulated utilizing a linear transfer analysis. The linear transfer analysis was utilized to identify only the facilities that had a high response to the transfer (>3% OTDF). The result of the transfer included a number of 500 kV impacted facilities along the eastern half of the Southern Company system which can be seen in Map 4. The majority of the load and generation modified within the Southern Company system and the majority of the higher voltage transmission interconnections between the Southern Company and FRCC interface resides on the eastern half of the Southern Company system. This was determined to be the root cause of the transmission facilities negatively impacted by this extreme transfer.

Tennessee Valley Authority

As one of the PA's included in the sink area for the Heat Wave and Drought scenario, the TVA system was modified to import 2890 MW in addition to the firm interchange commitments already modeled in the power flow case. To model the effect of the Heat Wave and Drought condition on the TVA system, the load was scaled up 1341 MW and the generation was scaled down 1076 MW. These transfer amounts were physically modeled in the power flow case as part of the 20 GW Eastern Interconnect transfer while the remaining 10 GW transfer was simulated utilizing a linear transfer analysis. The linear transfer analysis was utilized to identify only the facilities that had a high response to the transfer (>3% OTDF). The result of the transfer analysis identified a number of 500 kV impacted facilities along the eastern side of the TVA system, as well as several 500 kV and 161 kV impacted facilities along the interface with MISO on the northwestern side of the TVA system, that become limits to transfer. These facilities can be seen on Map 4. A major portion of the north to south flow to support the drought areas comes from PJM, and the majority of the higher voltage transmission interconnections between the TVA and PJM and the TVA and SOCO interfaces reside on the eastern side of the TVA system. Additionally, on the northwestern side of the TVA system, the interface between TVA and MISO forms the boundary between the transfer source and sink. Together, these were determined to be the root causes of the transmission facilities negatively impacted by this extreme transfer.

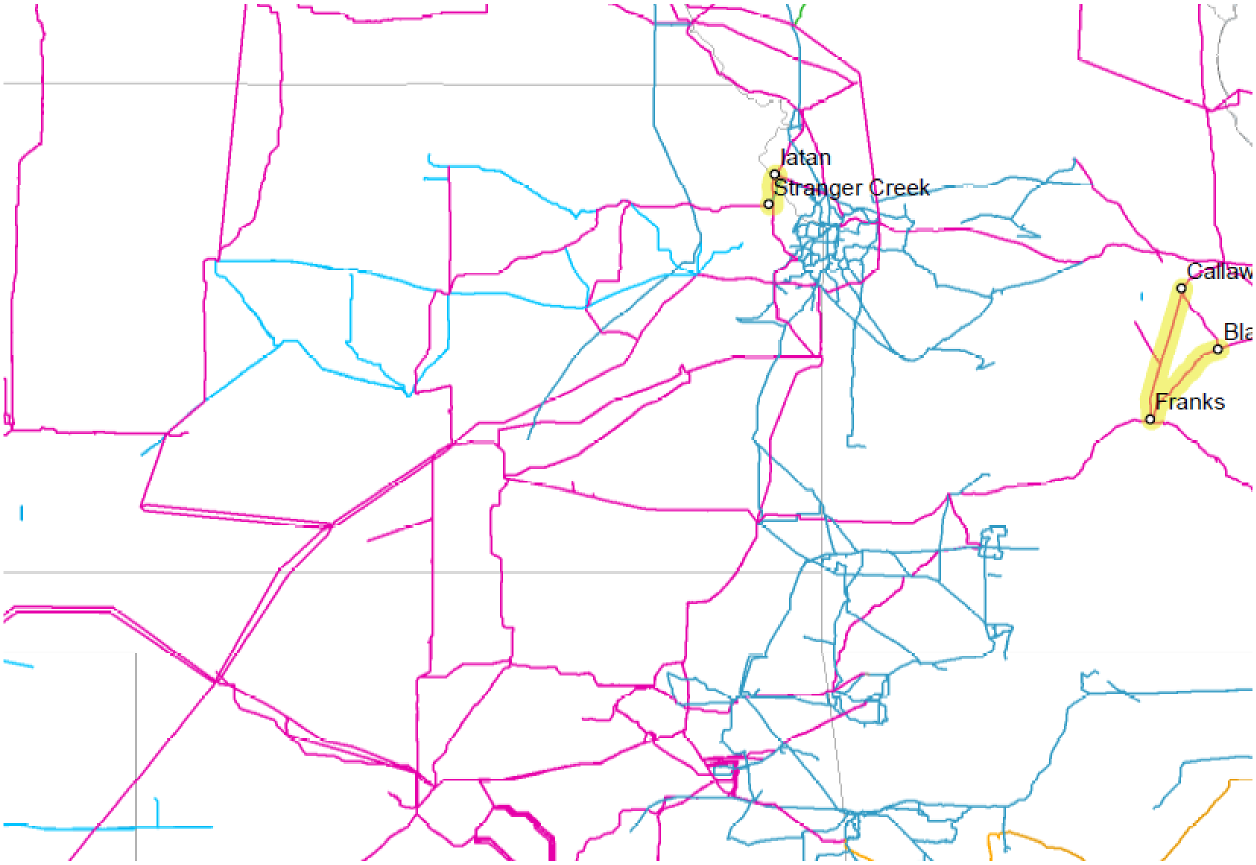
Duke Energy Carolinas

As one of the PA's included in the sink area for the Heat Wave and Drought scenario, the DEC system was modified to import 1913 MW in addition to the firm interchange commitments already modeled in the power flow case. To model the effect of the Heat Wave and Drought condition on the DEC system, the load was scaled up 1010 MW and the generation was scaled down 802 MW. These transfer amounts were physically modeled in the power flow case as part of the 20 GW Eastern Interconnect transfer while the remaining 10 GW transfer was simulated utilizing a linear transfer analysis. The linear transfer analysis was utilized to identify only the facilities that had a high response to the transfer (>3% OTDF). The result of the transfer analysis identified a number of 500 kV and 230 kV facilities that become limits to transfer. These facilities can be seen on Map 4. A major portion of the north to south flow to support the drought areas comes from the PJM area and must flow on the DEC 500 kV backbone paths through the center of the system and down into the connection with SOCO's 500 kV. Limits were identified on the DEC 500 kV network and at off take points from the 500 kV down into the 230 kV to serve the increased DEC area load/reduced generation as well as support flow through to the SOCO and FRCC regions.

LG&E/KU

The result of the transfer analysis identified the Brown N to Alcalde to Pineville 345 kV and Pineville to Pocket 500 kV (to Phipps Bend TVA 500 kV) path as a potential transfer limit (several different sections). This pathway is one of several alternative North to South transfer paths. Historically and according to this study, this path is heavily loaded during outages on the 765 kV/500 kV paths between points north and points south (and vice versa). These facilities can be seen on Map 4. A portion of the north to south flow to support the drought areas comes from the PJM area and must flow on the alternative path through LGE/KU via the AEP to Ghent to Brown to Pineville to Pocket to Phipps Bend 345/500 kV path during contingencies on the 500 kV system. Limits were identified on this path to serve the increased load in the drought area.

Map 5: Transmission Constraints Identified within SPP



Southwest Power Pool

Large North to South flows in the Missouri River valley between Omaha and Kansas City have created congestion historically. EHV transmission expansion to address this issue resulted in the MINT line being placed in service in the early 1990s. More recently, in 2010, SPP approved construction of the 181 mile, $404M Nebraska City – Mullin Creek – Sibley 345kV project as part of the Priority Projects. The Nebraska City – Mullin Creek – Sibley 345kV project is proceeding on schedule and will be placed in service in 2017.

This EIPC drought scenario provides significant stress on this same area and is showing that the Iatan – Stranger Creek 345kV line would be loaded slightly above its existing thermal rating limits for an outage of the Pleasant Hill – Sibley 345kV line. SPP is not concerned about this limit for two reasons. First, additional EHV transmission capability is readily available on this existing facility since current line ratings are based on terminal, and not conductor, limits. More importantly, the 2015 ITP10 study has identified that the conversion of the existing 18 mile Iatan – Stranger Creek 161kV line to its original design voltage of 345kV is an economic upgrade that should be completed in 2019. That $16.5M conversion project (which was enabled with minimal incremental cost and effort was predicated on the rightsizing the original outlet facilities for the Iatan plant) is expected to be approved by the SPP Board in January 2015.

Glossary of Terms

Alcoa	Alcoa Power Generating, Inc.
ATC	American Transmission Company
DEC	Duke Energy Carolinas
DEF	Duke Energy Florida
DEP	Duke Energy Progress
EEI	Electric Energy Inc.
EIPC	Eastern Interconnect Planning Collaborative
EISPC	Eastern Interconnection States' Planning Council
FCITC	First Contingency Incremental Transfer Capability
FPL	Florida Power & Light
IESO	Independent Electricity System Operator
ISO-NE	ISO New England Inc.
JEA	formerly Jacksonville Electric Authority
LGE/KU	LG&E and KU Energy, comprised of Louisville Gas & Electric, Kentucky Utilities, Old Dominion Power, and Western Kentucky Energy
MAPP	Mid-continent Area Power Pool
MISO North	Midcontinent Independent System Operator, northern region
MISO South	Midcontinent Independent System Operator, southern region
NBSO	New Brunswick System Operator
NERC	North American Electric Reliability Corporation
NPCC	Northeast Power Coordinating Council
NYISO	New York ISO
OTDF	Outage Transfer Distribution Factor
PJM	PJM Interconnection LLC
PS	PowerSouth Energy Cooperative
RTEP	Regional Transmission Expansion Plan
SC	South Carolina Public Service Authority
SCEG	South Carolina Electric & Gas Company
SERC	Southeastern Electric Reliability Council
SOCO	Southern Company
SPP	Southwest Power Pool
SSMFLWG	Steady State Modeling and Load Flow Working Group
TOTS	Transmission Owners' Transmission Solutions
TPL	Transmission Planning
TVA	Tennessee Valley Authority

Appendix F: Changes to Transmission Facilities

The Appendix is a Microsoft Excel Spreadsheet and is posted at the link below:

http://www.eipconline.com/Non-DOE_Documents.html

The most current copy is named: *Final_EIPC_Roll-up_Appendix_F_2014.12.17.xlsx*.

Appendix G: Changes to Generation Included in Roll-Up Model

The Appendix is a Microsoft Excel Spreadsheet and is posted at the link below:

http://www.eipconline.com/Non-DOE_Documents.html

The most current copy is named: *Final_EIPC_Roll-up_Appendix_G_2014.12.17.xlsx*.

Appendix H: Gap Analysis - Linear Transfer Results

The Appendix is a Microsoft Excel Spreadsheet and is posted at the link below:

http://www.eipconline.com/Non-DOE_Documents.html

The most current copy is named: *Final_EIPC_Roll-up_Appendix_H_2014.11.07.xlsx*.

Appendix I: Heat Wave and Drought – Case Modifications

The table below identifies the amount of transfer that was modeled for each area, in addition to the base transfer levels that were already in the case. The number in the Transfer Amount column represents the amount that the respective area's interchange was adjusted. The Gen Scaled and Load Scaled columns represent the amount of Generation and Load respectively that was scaled to produce the desired amount in the Transfer Amount column. The reason the transfer amount does not match the scaled amount is primarily due to loses. For example, PJM (area 10) was scheduled to export 7,029.9 additional MW out of their area. To accomplish this transfer, it required Generation to be scaled up 7,360 MW.

Area	Area Name	Source/Sink	Transfer Amount	Gen Scaled	Load Scaled
10	PJM	Source	7029.9	7360.0	0.0
101	ISO-NE	Source	266.0	356.0	0.0
102	NYISO	Source	2134.0	2388.4	0.0
103	IESO	Source	990.0	1025.6	0.0
104	TE	Source	315.1	313.8	0.0
105	NB	Source	286.9	286.9	0.0
106	NS	Source	210.4	219.4	0.0
107	CORNWALL	Source	0.0	0.0	0.0
207	HE	Source	1.6	2.3	0.0
208	DEI	Source	178.5	125.1	0.0
210	SIGE	Source	0.0	35.3	0.0
216	IPL	Source	0.0	-16.4	0.0
217	NIPS	Source	137.7	140.9	0.0
218	METC	Source	702.1	731.7	0.0
219	ITCT	Source	163.7	178.3	0.0
295	WEC	Source	396.1	387.7	0.0
314	BREC	Source	2.3	80.5	0.0
333	CWLD	Source	1.8	2.9	0.0
345	DVP	Source	100.8	178.8	0.0
356	AMMO	Source	2.0	151.0	0.0
357	AMIL	Source	578.2	657.0	0.0
360	CWLP	Source	0.1	0.3	0.0
361	SIPC	Source	0.4	12.1	0.0
363	LGEE	Source	176.3	369.1	0.0
600	XEL	Source	1241.5	1320.8	0.0
608	MP	Source	414.9	431.7	0.0
613	SMMPA	Source	0.6	-3.6	0.0
615	GRE	Source	319.3	322.6	0.0
620	OTP	Source	521.1	564.7	0.0
627	ALTW	Source	1601.8	1590.1	0.0

633	MPW	Source	0.2	0.5	0.0
635	MEC	Source	1143.6	1157.5	0.0
652	WAPA	Source	350.4	454.8	0.0
661	MDU	Source	237.2	251.1	0.0
667	MH	Source	170.4	160.3	0.0
680	DPC	Source	6.4	4.2	0.0
694	ALTE	Source	95.0	80.7	0.0
696	WPS	Source	147.0	145.8	0.0
697	MGE	Source	2.4	1.4	0.0
698	UPPC	Source	3.6	3.6	0.0

Area	Area Name	Source/Sink	Transfer Amount	Gen Scaled	Load Scaled
326	EES-EMI	Sink	-381.2	-149.9	194.6
327	EES-EAI	Sink	-654.1	-319.4	315.7
328	PLUM	Sink	-26.8	-26.8	0.0
329	OMLP	Sink	-0.5	0.0	0.5
331	BCA	Sink	-0.3	-0.2	0.2
332	LAGN	Sink	-217.0	-97.6	66.6
334	WMU	Sink	-1.2	0.0	2.7
335	CWAY	Sink	-3.0	0.0	3.2
336	BUBA	Sink	-1.0	0.0	1.8
337	PUPP	Sink	0.0	0.0	0.0
338	DERS	Sink	-0.8	0.0	0.9
339	NLR	Sink	-3.6	-0.2	4.8
340	CPLE	Sink	-1113.6	-414.5	613.7
341	CPLW	Sink	-84.7	-28.5	45.4
342	DUK	Sink	-1913.5	-802.1	1010.3
343	SCEG	Sink	-501.0	-249.4	242.3
344	SC	Sink	-396.7	-149.1	236.5
346	SOCO	Sink	-4253.1	-2165.9	1905.5
347	TVA	Sink	-2890.0	-1076.6	1341.3
349	SMEPA	Sink	-65.0	-27.5	35.4
350	PS	Sink	-108.2	-60.2	43.4
351	EES	Sink	-1343.9	-573.1	783.7
352	YAD	Sink	-0.1	-0.9	0.0
362	EEI	Sink	-55.9	-53.9	0.0
365	SMT	Sink	-4.5	-5.2	0.0
366	TAP	Sink	-1.1	0.0	1.1
401	FPL	Sink	-578.4	-209.5	313.2
402	PEF	Sink	-295.4	-127.4	165.4

403	FTP	Sink	-1.4	0.0	1.5
404	GVL	Sink	-10.4	-3.9	5.6
405	HST	Sink	-1.8	-0.5	1.4
406	JEA	Sink	-74.2	-31.2	39.9
407	KEY	Sink	-1.6	0.0	1.7
409	LWU	Sink	-1.4	-0.3	1.1
410	NSB	Sink	-2.0	-0.9	1.3
411	FMPP	Sink	-73.6	-39.0	33.6
412	SEC	Sink	-31.5	-23.9	3.8
415	TAL	Sink	-12.0	-4.6	6.4
416	TECO	Sink	-103.3	-49.3	53.9
417	VER	Sink	-2.4	-0.2	2.2
419	RCU	Sink	-3.1	-0.5	2.6
502	CLEC	Sink	-238.8	-117.3	122.5
503	LAFA	Sink	-31.7	-5.8	24.6
504	LEPA	Sink	-4.3	-1.3	3.0
515	SWPA	Sink	-130.1	-59.2	51.0
520	AEPW	Sink	-866.3	-377.9	477.8
523	GRDA	Sink	-103.3	-45.6	54.6
524	OKGE	Sink	-594.8	-275.8	317.9
525	WFEC	Sink	-127.7	-53.6	72.0
526	SPS	Sink	-594.3	-304.3	271.2
527	OMPA	Sink	-37.1	-3.5	17.4
531	MIDW	Sink	-24.5	31.5	20.9
534	SUNC	Sink	-105.2	-2.2	55.9
536	WERE	Sink	-523.3	-217.4	240.4
540	GMO	Sink	-139.8	7.4	97.5
541	KCPL	Sink	-352.8	-137.8	171.8
542	KACY	Sink	-47.0	-21.5	25.0
544	EMDE	Sink	-101.4	-38.1	57.5
545	INDN	Sink	-24.0	-8.8	15.2
546	SPRM	Sink	-67.4	-27.7	36.4
640	NPPD	Sink	-304.8	-29.4	176.2
645	OPPD	Sink	-254.7	-93.9	132.4
650	LES	Sink	-42.2	-7.8	34.7

Appendix J: Heat Wave and Drought – Linear Transfer Results

The Appendix is a Microsoft Excel Spreadsheet and is posted at the link below:

http://www.eipconline.com/Non-DOE_Documents.html

The most current copy is named: *Final_EIPC_Roll-up_Appendix_J_2014.11.17.xlsx*.

Appendix K: Heat Wave and Drought – Constraint Map

The Scenario B Constraint Map is an Adobe PDF document and is posted at the link below:

http://www.eipconline.com/Non-DOE_Documents.html

The most current copy is named: *Final_EIPC_Impacted_Transmission_Facilities_2015.01.23.pdf*.