South Carolina Regional Transmission Planning

Stakeholder Meeting

Columbia, SC

WebEx

October 15, 2018 - 2 PM – 4 PM

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Purpose and Goals for Today's Meeting

- Review and Discuss Economic Power Transfer Studies – Initial Results
- Reliability Assessments and Multi-Party Studies
- EIPC Update

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Transfer Analysis and Results

Jake Biddix

Transfer Analysis Scenarios

Scenario	Source	Sink	Transfer Amount (MW)	Year	Type
1	SOCO	SC	1000	2022 Summer	Load to Gen
2	SC	DEC	1000	2022 Summer	Load to Load
3	DEC	SC	1000	2022 Summer	Gen to Gen

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Transfer Analysis Results

Transfer	Notes	NITC (MW)	FCITC (MW)	Limiting Facility	Rating (MVA)	TDF (%)	Outaged Facility
SCPSA to Duke		1000+		No limit found at 1000 MW			None
			1000+	No limit found at 1000 MW			Any tested facility
Duke to SCPSA		1000+		No limit found at 1000 MW			None
			1000+	No limit found at 1000 MW			Any tested facility
SOCO to SCPSA		1000+		No limit found at 1000 MW			None
			50	Denmark-Cope 115 kV 1	138	3.8	SRS-Canadys 230 kV 1
			550	Denmark-Cope 115 kV 1	138	3.4	Shaw Creek Solar Tap-WARD 230 BUS 2 230 kV 1
			700	Denmark-Cope 115 kV 1	138	3.4	Shaw Creek Solar Tap-Graniteville 230 kV 1
			1000+	No other limit found at 1000 MW			Any other tested facility

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Economic Transmission Planning Studies

Skylar Adams
Jake Biddix

Study Methodology

- Linear transfer analysis using PTI's TARA Software. Analysis includes single contingencies of SERC while monitoring the SCE&G and Santee Cooper's internal Transmission Systems.

- A Thermal and Voltage analysis using PTI's PSS/E and PowerWorld Simulator Software. This analysis of SCE&G and Santee Cooper internal transmission systems included single contingencies, double contingencies and selected bus outages with and without the simulated transfer in effect. However, this analysis is not a complete testing of NERC TPL standards.

Case Development

- The most current LTSG models were used for the systems external to SCE&G and SCPSA as a starting point for the study case.

- The study case(s) include the detailed internal models for SCE&G and SCPSA. The study case(s) include new transmission additions currently planned to be in-service for the given year (i.e. in-service by summer 2022 for 2022S case).

Case Development

- SCE&G and SCPSA have coordinated interchange which includes all confirmed long term firm transmission reservations with roll-over rights applicable to the study year.
- The coordinated cases were used to build base cases.
- Base cases were used to build transfer cases.

Study Results

- SCE&G and SCPSA have reported results based on thermal loading greater than 90% and voltage violations in accordance with their planning criteria.

- Overloaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were also excluded.

2018 Economic Planning Scenarios

Selected by Stakeholders During the March 16, 2018 Meeting

Source	Sink	Study Year	Transfer
Southern Company	Santee Cooper	2022 Summer	1000 MW
Santee Cooper	Duke Carolinas	2022 Summer	1000 MW
Duke Carolinas	Santee Cooper	2022 Summer	1000 MW

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Power Flow Base Cases

- 2018 LTSG Series Internal PSSE Models
  - 2022 Summer

Preliminary Result Components

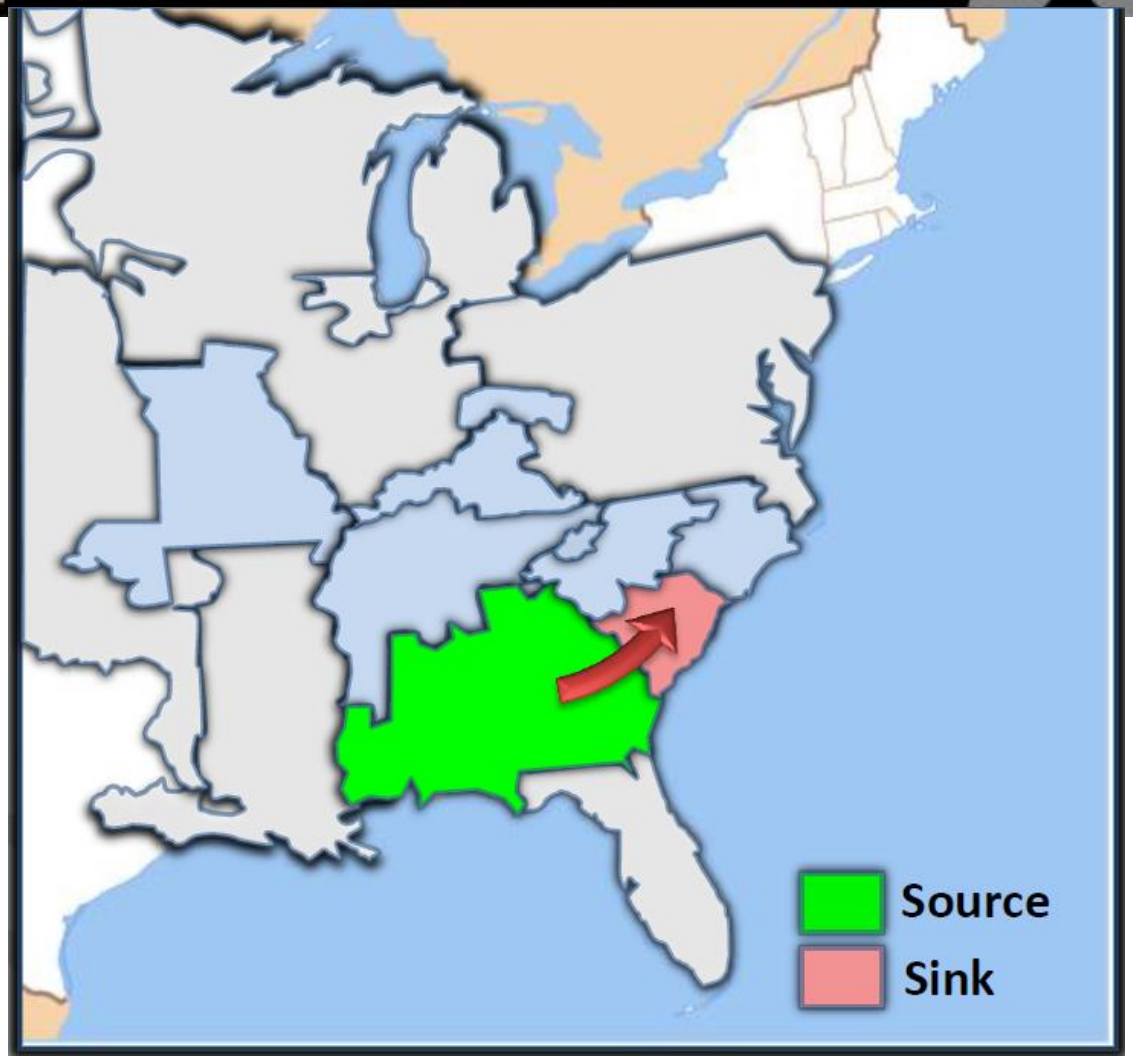
- The following information is preliminary and subject to change pursuant to additional analyses.
- The following information does not represent a commitment to proceed with the recommended enhancements nor implies that the recommended enhancements could be implemented by the study dates.
- These potential solutions only address constraints identified within the respective areas that comprise the SCRTP. Balancing Areas external to the SCRTP were not monitored, which could result in additional limitations and required system enhancements.

Scenario 1

2022 Summer

SOCO – SCPSA 1000 MW

2022 Summer Study
SOCO – SCPSA 2000 MW



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Preliminary Results – SCE&G

Southern Company-SCPSA 1000 MW
2022 Summer Study

Constrained Facility	% Base Loading	% Study Loading	Contingency
Aiken – Graniteville 115 kV	90.8 %	104.8 %	Loss of Graniteville Bus
Aiken – Toolebeck 115 kV	<90 %	101.9 %	Graniteville Bus Tie Breaker Failure
Canadys – SRS 230 kV	<90 %	101.3 %	Loss of Vogtle – West McIntosh 500 kV Line
Ritter – Yemassee 230 kV	<90 %	100.6 %	Loss of common structure: Yemassee (SCE&G) – Yemassee (SCPSA) 230 kV Canadys – Yemassee 230 kV

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Preliminary Results – SCE&G

Southern Company-SCPSA 1000 MW

2022 Summer Study

Description	Solution	Cost (2018$)	Duration (Months)
Aiken – Graniteville 115 kV	Re-Conductor Facility	850,000	12-18
Aiken – Toolebeck 115 kV	Re-Conductor Facility	600,000	12-18
Canadys – SRS 230 kV	Re-Conductor Facility	62,000,000	66-72
Ritter – Yemassee 230 kV	Re-Conductor Facility	20,400,000	24-36
	TOTAL (2018$)	$83,850,000	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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Preliminary Results – SCPSA

Southern Company-SCPSA 1000 MW
2022 Summer Study

Constrained Facility	% Base Loading	% Study Loading	Contingency
*None Identified	---	---	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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Preliminary Results – SCPSA

Southern Company-SCPSA 1000 MW
2022 Summer Study

Description	Solution	Cost (2018$)	Duration (Months)
		N/A	N/A
	TOTAL (2018$)	$0	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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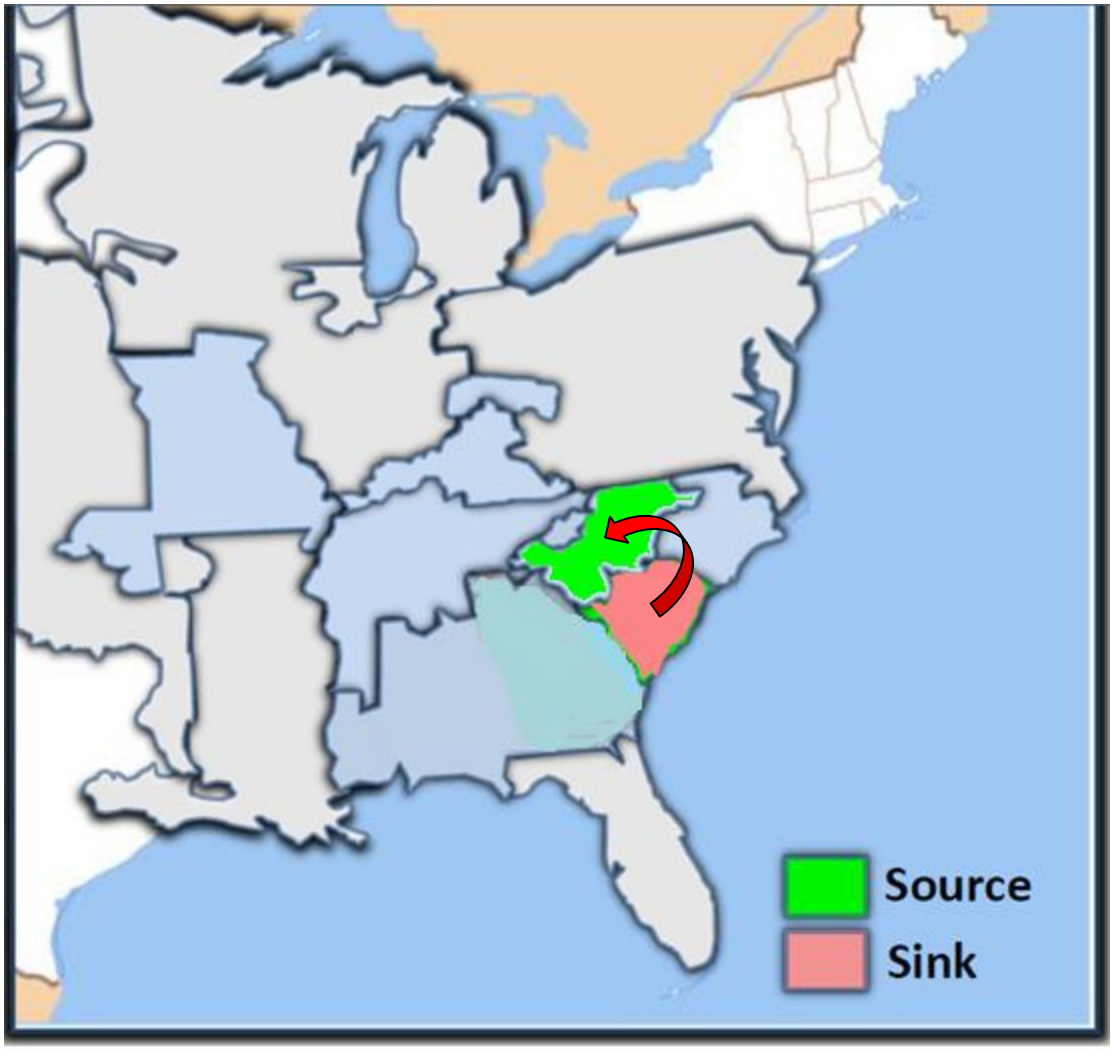
Scenario 2

2022 Summer

SCPSA – Duke 1000 MW

2022 Summer Study
SCPSA – Duke Carolina 1000 MW



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Preliminary Results – SCE&G

SCPSA – Duke Carolina 1000 MW
2022 Summer Study

Constrained Facility	% Base Loading	% Study Loading	Contingency
*None Identified	---	---	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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Preliminary Results – SCE&G

SCPSA – Duke Carolinas 1000 MW
2022 Summer Study

Description	Solution	Cost (2018$)	Duration (Months)
		N/A	N/A
	TOTAL (2018$)	$0	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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Preliminary Results – SCPSA

SCPSA – Duke Carolina 1000 MW
2022 Summer Study

Constrained Facility	% Base Loading	% Study Loading	Contingency
*None Identified	---	---	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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Preliminary Results – SCPSA

SCPSA – Duke Carolinas 1000 MW
2022 Summer Study

Description	Solution	Cost (2018$)	Duration (Months)
*None Identified		N/A	N/A
	TOTAL (2018$)	$0	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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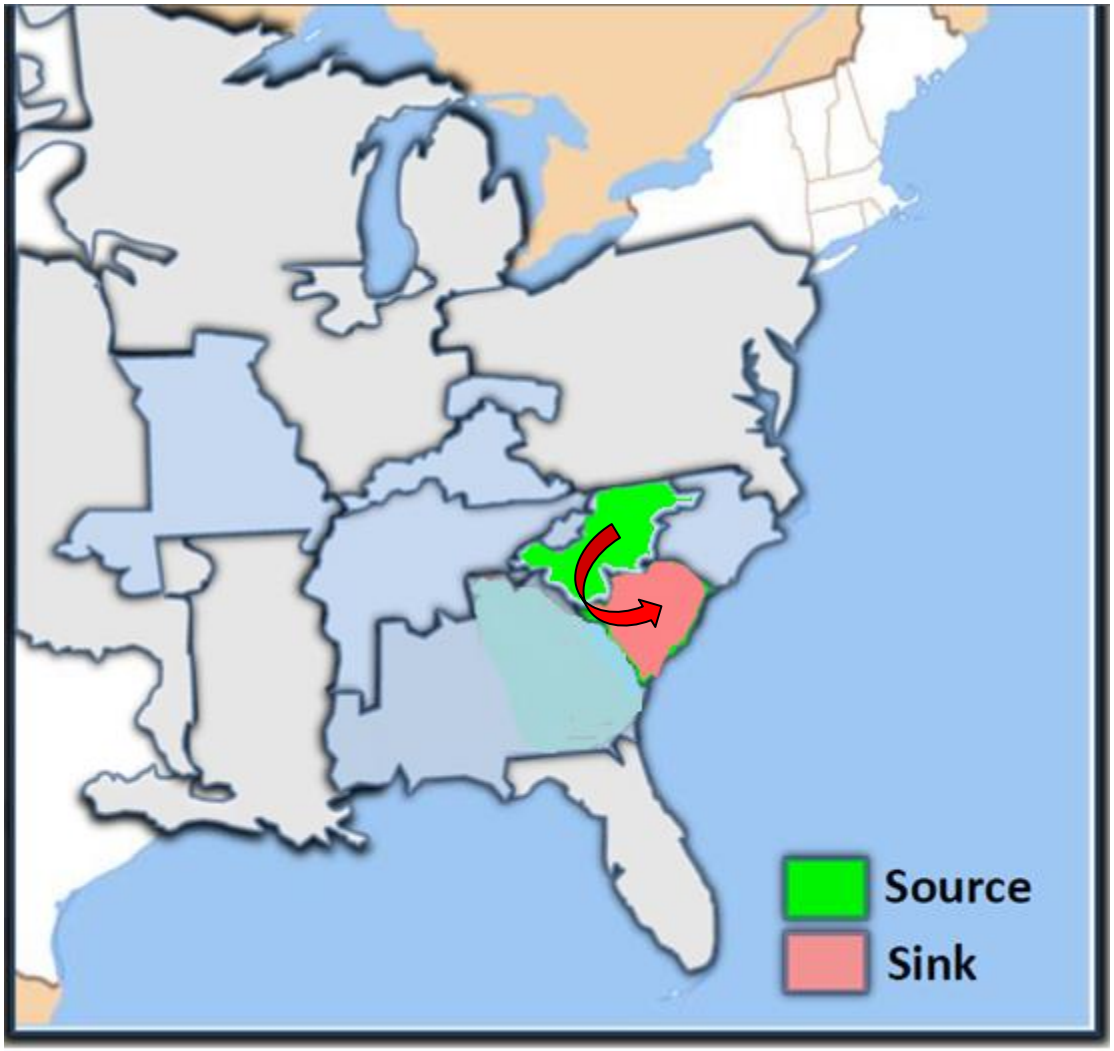
Scenario 3

2022 Summer

Duke - SCPSA 1000 MW

2022 Summer Study
Duke Carolinas - SCPSA 1000 MW



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Preliminary Results – SCE&G

Duke Carolinas - SCPSA 1000 MW

2022 Summer Study

Constrained Facility	% Base Loading	% Study Loading	Contingency
Aiken – Graniteville 115 kV	90.8 %	97.7 %	Graniteville Bus Tie Breaker Fault
Aiken – Toolebeck 115 kV	<90 %	92.3 %	Graniteville Bus Tie Breaker Fault
Canadys – SRS 230 kV	<90 %	96.9 %	Loss of Vogtle – West McIntosh 500 kV line

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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Preliminary Results – SCE&G

Duke Carolinas-SCPSA 1000 MW

2022 Summer Study

Description	Solution	Cost (2018$)	Duration (Months)
Aiken – Graniteville 115 kV	Re-Conductor Facility	850,000	12-18
Aiken – Toolebeck 115 kV	Re-Conductor Facility	600,000	12-18
Canadys – SRS 230 kV	Re-Conductor Facility	62,000,000	66-72
	TOTAL (2018$)	$63,450,000	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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Preliminary Results – SCPSA

Duke Carolinas - SCPSA 1000 MW

2022 Summer Study

Constrained Facility	% Base Loading	% Study Loading	Contingency
*None Identified	---	---	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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Preliminary Results – SCPSA

Duke Carolinas-SCPSA 1000 MW
2022 Summer Study

Description	Solution	Cost (2018$)	Duration (Months)
		N/A	N/A
	TOTAL (2018$)	$0	

*Potentially overloaded or loaded facilities that had a low response to the requested transfer were excluded and problems or issues identified that are local area in nature were excluded

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2018 Economic Planning Scenarios

Preliminary Results - SCPSA

#	Source	Sink	MW	Year	FCITC LIMIT	LIMIT/CONTINGENCY
1	SOCO	SC	1000	2022S	No Limit found	N/A
2	SCPSA	Duke	1000	2022S	No Limit found	N/A
3	Duke	SCPSA	1000	2022S	No Limit found	N/A

2018 Economic Planning Scenarios

Preliminary Results – SCE&G

#	Source	Sink	MW	Year	FCITC LIMIT	LIMIT/CONTINGENCY
1	SOCO	SC	1000	2022S	No Limit found	N/A
2	SCPSA	Duke	1000	2022S	No Limit found	N/A
3	Duke	SCPSA	1000	2022S	No Limit found	N/A

Reliability Assessment Studies

Jake Biddix
Skylar Adams

Multi-Party Assessments

- SERC Reliability Corporation Assessments
- Eastern Interconnection Reliability Assessment Group (ERAG)
- Carolina Transmission Coordination Arrangement (CTCA) Assessments

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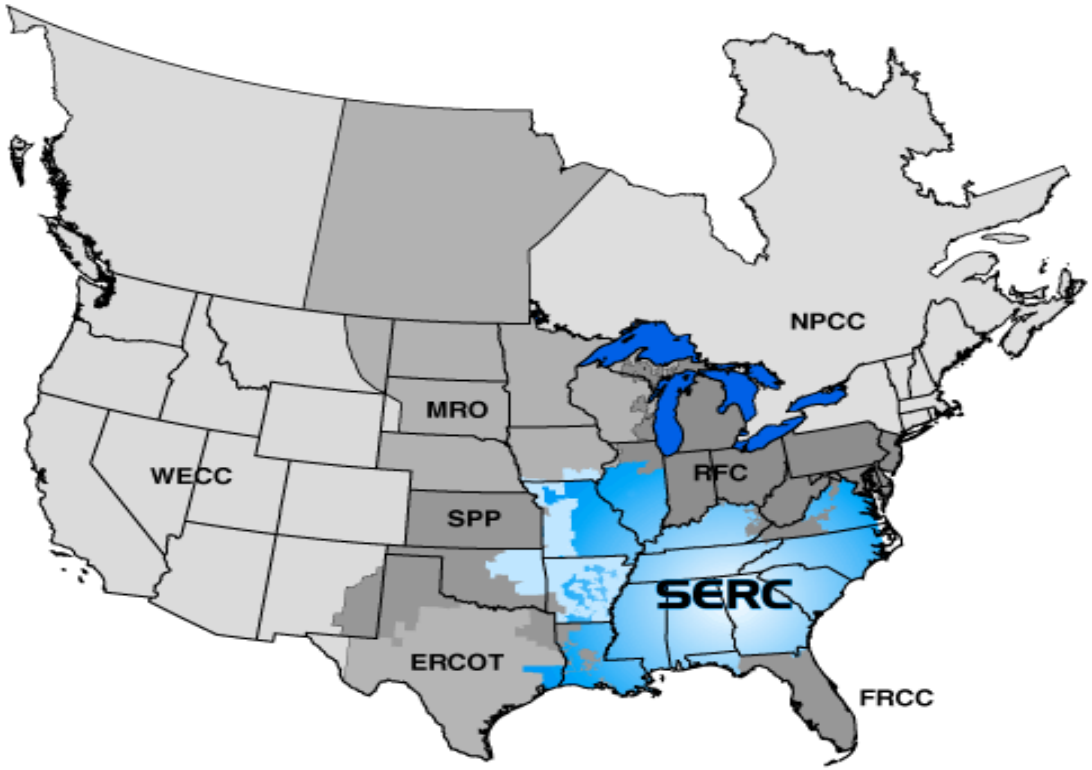
SERC Future Year Assessments
Long Term Working Group (LTWG)



SERC LTWG Study
Purpose

- Analyze the performance of the members' transmission systems and identify limits to power transfers occurring non-simultaneously among the SERC members.
- Evaluate the performance of bulk power supply facilities under both normal and contingency conditions for future years.
- Focus on the evaluation of sub-regional and company-to-company transfer capability.

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SERC Long Term Working Group
2018 Work Schedule

- 2018 DBU kickoff began in January, 2018
- Power flow cases scheduled finalized on June 14, 2018
- Future Study Year Case: 2023 Summer Peak Load
- Study and report to be completed by LTWG June thru October
- Final Report to be approved in December, 2018

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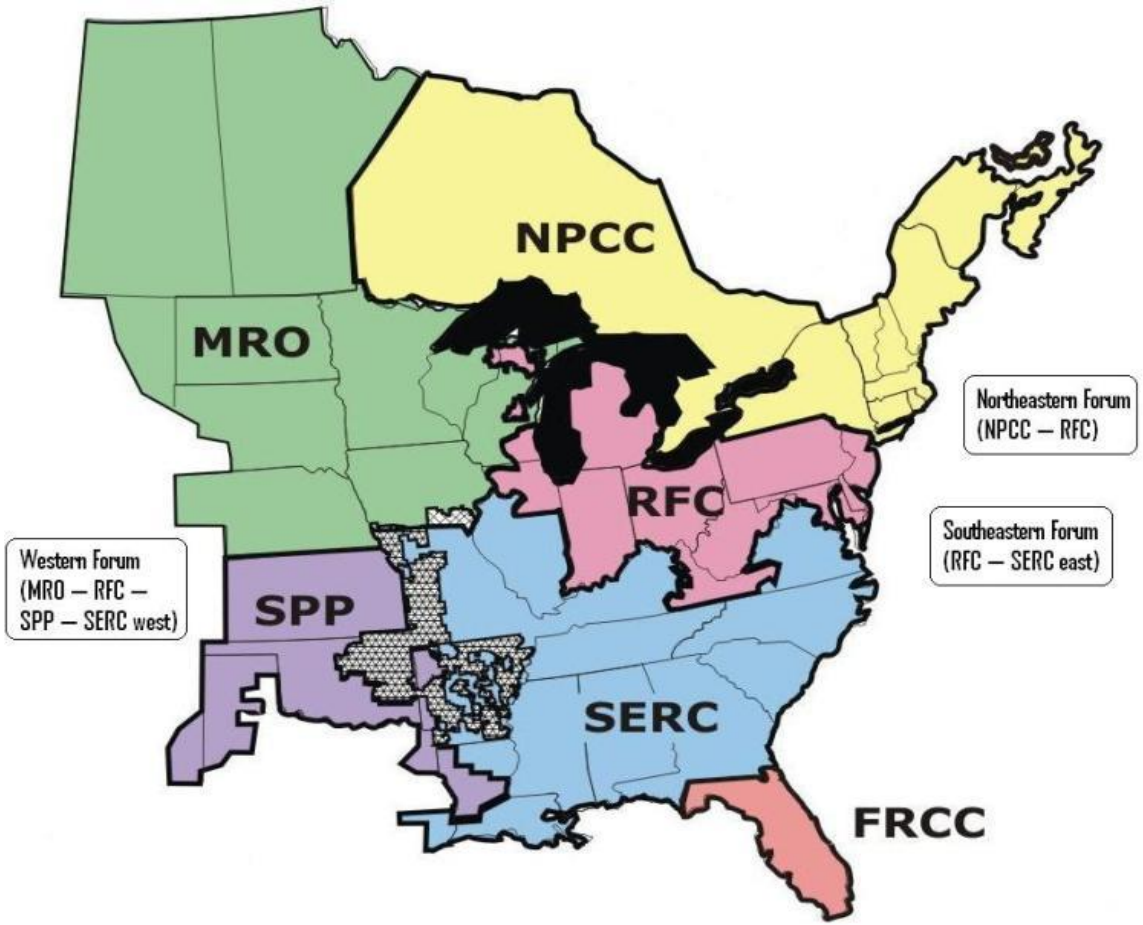
Eastern Interconnection Reliability Assessment Group (ERAG) Assessments



- ReliabilityFirst Corporation (RF)
- Midwest Reliability Organization (MRO)
- Florida Reliability Coordinating Council (FRCC)
- Northeast Power Coordinating Council (NPCC)
- Southeastern Electric Reliability Council (SERC)
- Southwest Power Pool Regional Entity (SPP RE)

ERAG MMWG

The Multiregional Modeling Working Group (MMWG) is responsible for developing a library of solved power flow models and associated dynamics simulation models of the Eastern Interconnection.

The models are for use by the Regions and their member systems in planning future performance and evaluating current operating conditions of the interconnected bulk electric systems.

ERAG MMWG 2018 activity

- MMWG power flow cases finalized October 2017
- Model update from August – September 2018
- Model approval October 2018

ERAG Assessments

- The purpose of the Eastern Interconnection Reliability Assessment Group (ERAG) is to further augment the reliability of the bulk-power system in the Eastern Interconnection through periodic studies of seasonal and longer-term forecasted transmission system conditions.

- No ERAG Long Term Study currently planned in 2018

CTCA Purpose

- Collection of agreements developed concurrently by the Principals, Planning Representatives, and Operating Representatives of multiple two-party Interchange Agreements
- Establishes a forum for coordinating certain transmission planning assessment and operating activities among the specific parties associated with the CTCA
- Participating entities:
  - -- Duke Energy Carolinas
  - -- Duke Energy Progress
  - -- South Carolina Electric & Gas
  - -- Santee Cooper

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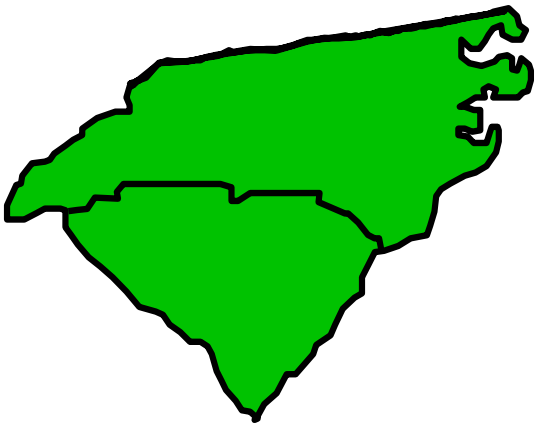
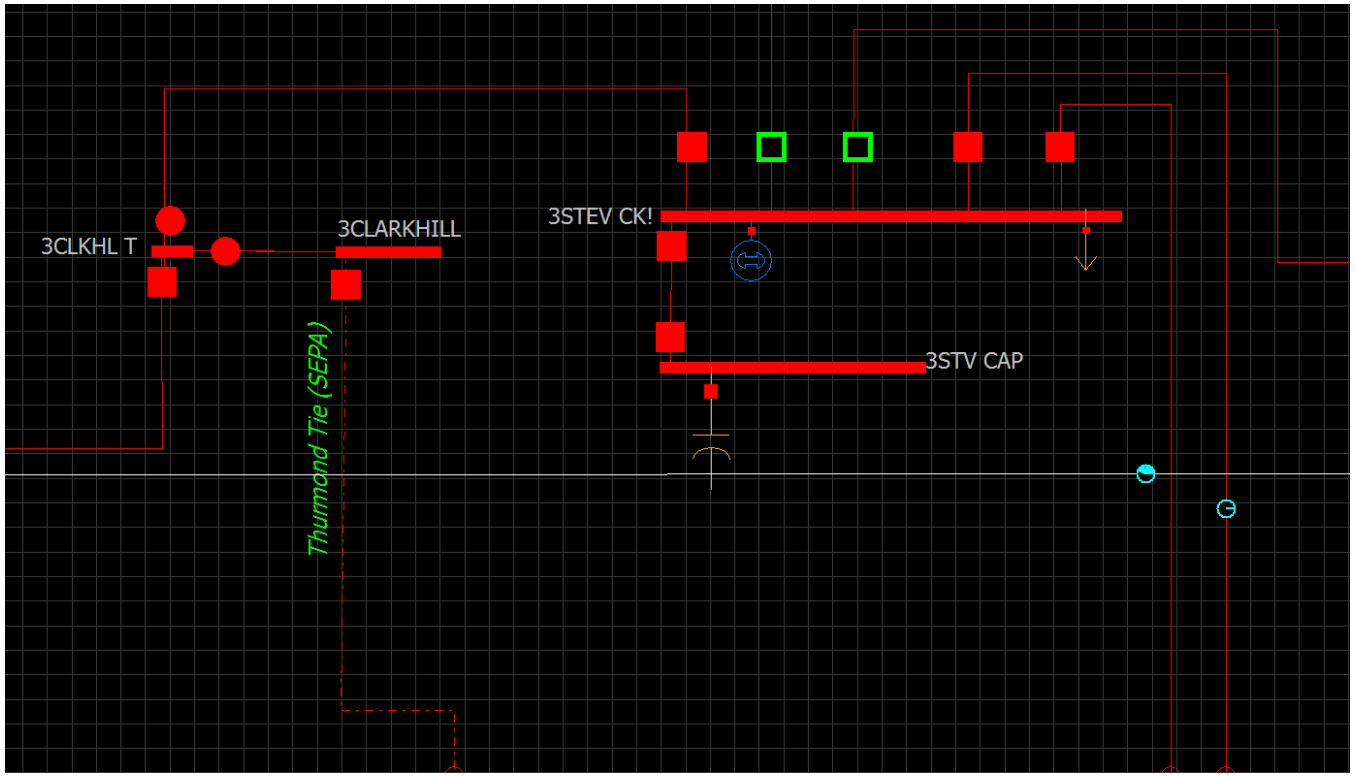
CTCA Future Year Assessments



- CTCA PFSG Study – effect of closing Thurmond Bus Tie
  - TPL-001 analysis
  - Transfer Study

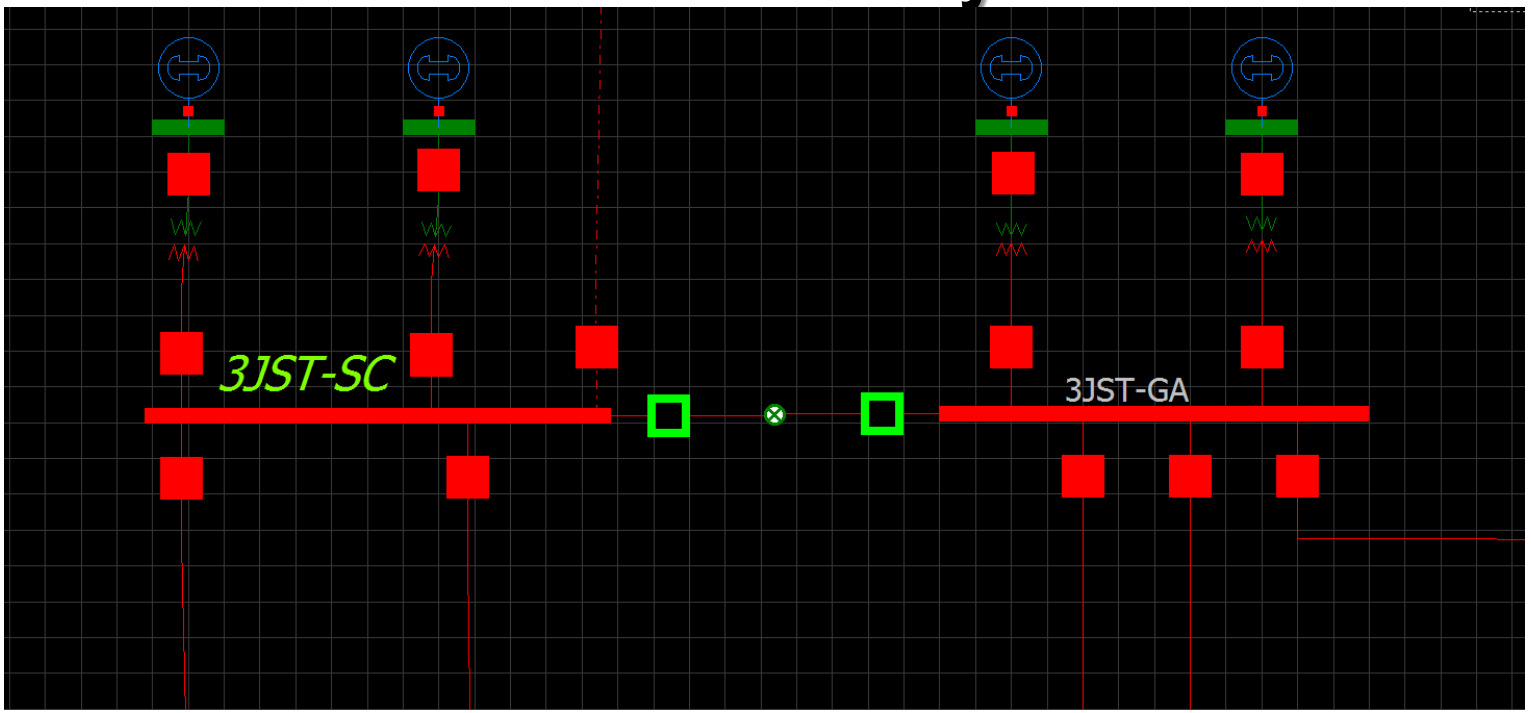
- 2018 NERC TPL-001 analysis study files coordination
  - Selected Power flow cases
  - Contingency files updated

CTCA Studies
Current Study



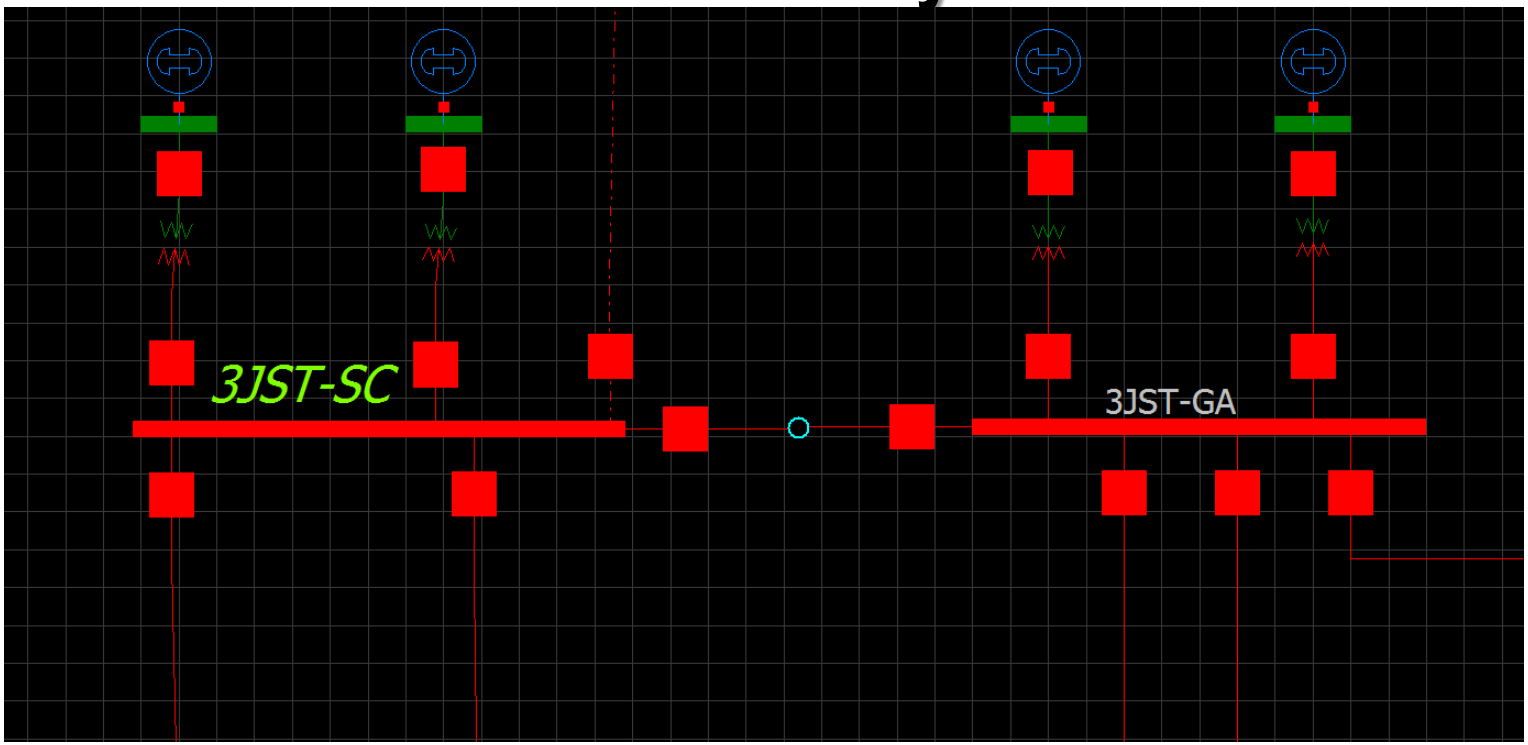
CTCA Studies

Current Study



CTCA Studies

Current Study



Questions?

Eastern Interconnection

Planning Collaborative

Frequency Response Task Force

Phil Kleckley

SCRTP Regional Stakeholder Meeting

October 11, 2018

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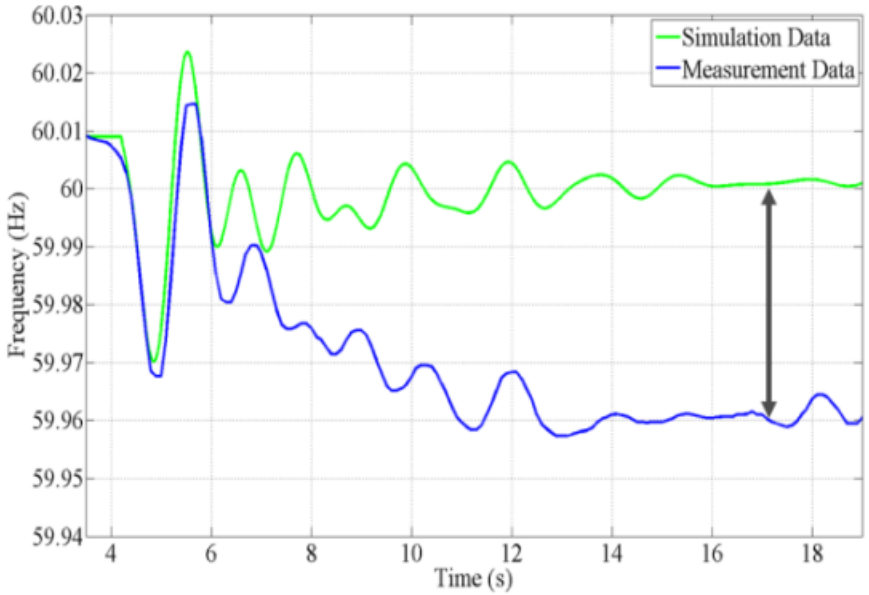
Frequency Response Issue

Eastern Interconnection frequency response simulations results not correlating closely with measurements



Mismatch between frequency response.

Background and Purpose

- Difficult to predict frequency response impacts of wind and photo-voltaic generation
- Approached by NERC Essential Reliability Services Working Group (ERSWG)
- Facilitate forward looking frequency response analysis

Background and Purpose

Support of NERC Essential Reliability Services Working Group Forward Looking Measures

- ERSWG Measurement 1 – Determine Synchronous Inertial Response (SIR) of Eastern Interconnection
- ERSWG Measurement 2 – Determine initial frequency deviation of largest contingency during minimum SIR conditions
- ERSWG Measurement 4 – Determine frequency response of Eastern Interconnection beyond initial deviation

Background and Purpose

EIPC Frequency Response Task Force has created an additional Measure for the Eastern Interconnection:

MW loss margin before reaching 59.5 Hz nadir.

- Will be capped at 10,000 MWs.
- The 59.5 Hz will be an average.

EIPC

Background and Purpose

- Generation sources need to provide frequency response to maintain synchronous and stable system operation
- Variable energy resources (VERs) do not provide frequency support comparable to high inertia fossil/nuclear sources
- Simulation of frequency response of VERs needs further development

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Tasks

- Build on work by University of Tennessee – Knoxville and Lawrence Berkeley National Laboratory
- Review current research on frequency response of Eastern Interconnection
- Establish baseline confidence in solutions provided by currently available models

Tasks

- Calculate inertia of MMWG cases
- Select historical low inertia and frequency events
- Collect historical dispatch data associated with frequency events
- Identify any gaps in MMWG frequency response models
- Identify potential improvements to model development practices

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Tasks

- Develop changes required to transform MMWG case into a low inertia dispatch with generator model modifications and create dynamics case
- Create base case(s) for future frequency response studies and identify data improvements
- Perform frequency response simulation tests
- Provide results to NERC ESRWG, NERC MMWG, other interconnections for future base case improvements

Results and Recommendations

- Provided NERC ERWS Measure Results to NERC for 2028 Long Term Reliability Analysis
- No credible loss of generation contingency results in Under-frequency load shedding in Eastern Interconnection
- Developed modeling recommendation for ERAG MMWG

Recommendations for ERAG MMWG

The FRTF recommendations to be presented to the MMWG for modeling as a result of the study

- #1 – Generator *Gross* Maximum Power Ratings
- #2 – Generator Governor Modeling (droop, deadband, maximum turbine power)
- #3 – Frequency Responsive Dynamics Files (load models)
- #4 – Need for New Low Inertia / Minimum Load Library Case

Continuing Tasks

- Outreach to other interconnections – monthly web conferences
- Provide input to NERC Long term Reliability Assessment report
- Continuing work with NERC Resource Subcommittee Power System Analysis Group
- Re-perform analysis on 2-3 year cycle

Questions?

Contact Phil Kleckley

pkleckley@scana.com

Next SCRTP Meeting

- Key assumptions and data used for modeling
- Reliability Planning process
- Review all major projects included in current Local Transmission Plans
- SCRTP Email Distribution List will be notified
- Register online

South Carolina Regional Transmission Planning

Stakeholder Meeting

Web Conference

October 15, 2018 - 2 PM – 4 PM

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