Southeastern Regional TRANSMISSION PLANNING

SERTP - 1st Quarter Meeting

First RPSG Meeting & Interactive Training Session

March 14th, 2023

Agenda

- **Safety**
- **2023 SERTP Process Overview**
- **Form the "RPSG"**
  - Regional Planning Stakeholders Group
  - Committee Structure & Requirements
- **Economic Planning Studies**
  - Review Requested Sensitivities for 2023
  - RPSG to Select up to Five Economic Planning Studies
- **Interactive Training Session**
  - Transfer Analysis and Bubble Diagrams – TVA
- **Miscellaneous**
  - Public Policy Requirement Stakeholder Requests
- **Next Meeting Activities**

SERTP

2023 SERTP Process Overview

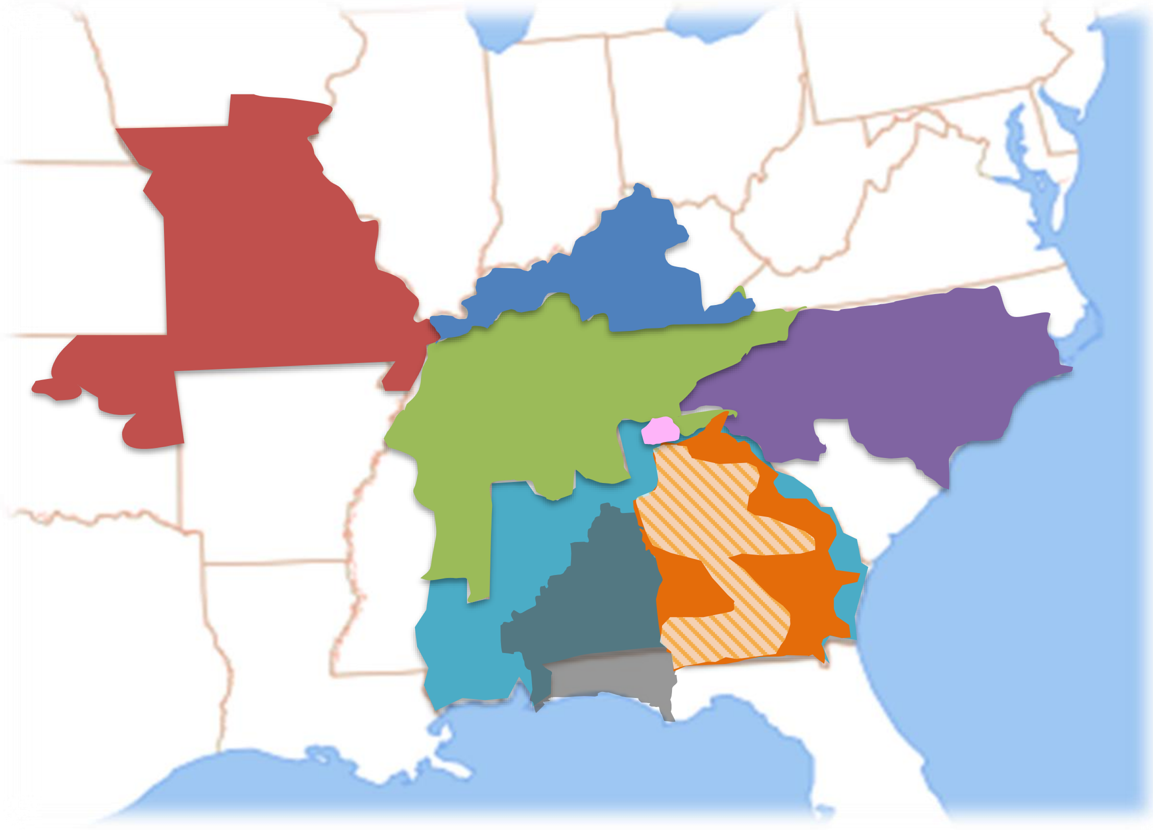
Process Information

- The SERTP process is a transmission planning process.
- Please contact the respective transmission provider for questions related to real-time operations or Open Access Transmission Tariff (OATT) transmission service.
- SERTP Website Address:
  - www.southeasternrtp.com

Southeastern Regional TRANSMISSION PLANNING

2023 SERTP

Southeastern Regional Transmission Planning (SERTP)



SERTP

- Associated Electric Cooperative Inc.
- Dalton Utilities
- Duke Energy
- Georgia Transmission
- LG&E KU
- MEAG Power
- PowerSouth Energy Cooperative
- Southern Company
- TVA

Upcoming 2023 SERTP Process

- **SERTP 1st Quarter –** ***1st RPSG Meeting & Interactive Training Session***

  March 14th, 2023 – Tucker, GA

  – Form RPSG
  – Select Economic Planning Studies
  – Interactive Training Session

- **SERTP 2nd Quarter –** ***Preliminary Expansion Plan Meeting***

  June 29th, 2023 – Chattanooga, TN

  – Review Modeling Assumptions
  – Preliminary 10 Year Expansion Plan
  – Stakeholder Input & Feedback Regarding the Plan

Upcoming 2023 SERTP Process

- **SERTP 3rd Quarter – *2nd RPSG Meeting***

  September 2023 - Virtual
  - Preliminary Results of the Economic Studies
  - Stakeholder Input & Feedback Regarding the Study Results
  - Discuss Previous Stakeholder Input on the Expansion Plan

- **SERTP 4th Quarter – *Annual Transmission Planning Summit & Input Assumptions***

  December 2023 - TBD
  - Final Results of the Economic Studies
  - Regional Transmission Plan
  - Regional Analyses
  - Stakeholder Input on the 2024 Transmission Model Input Assumptions

SERTP

Regional Planning Stakeholder Group (RPSG)

The SERTP Stakeholder Group

- RPSG – Regional Planning Stakeholder Group
- Serves Two Primary Purposes
  1) The RPSG is charged with determining and proposing up to five (5) Economic Planning Studies on an annual basis
  2) The RPSG serves as stakeholder representatives for the eight (8) industry sectors in interactions with the SERTP Sponsors

RPSG Committee Structure

RPSG Sector Representation

1. Transmission Owners / Operators
2. Transmission Service Customers
3. Cooperative Utilities
4. Municipal Utilities
5. Power Marketers
6. Generation Owner / Developers
7. Independent System Operators (ISOs) / Regional Transmission Operators (RTOs)
8. Demand Side Management / Demand Side Response

RPSG Committee Structure

- Sector Representation Requirements
  - Maximum of two (2) representatives per sector
  - Maximum of sixteen (16) total sector members
  - A single company, and all of its affiliates, subsidiaries, and parent company, is limited to participating in a single sector

RPSG Committee Structure

- Annual Reformation
  - Reformed annually at 1st Quarter Meeting
  - Sector members elected for a term of approximately one year
  - Term ends at start of following year’s 1st Quarter SERTP Meeting
  - Sector Members shall be elected by the Stakeholders present at the 1st Quarter Meeting
  - Sector Members may serve consecutive, one-year terms if elected
  - No limit on the number of terms that a Sector Member may serve

RPSG Committee Structure

- Simple Majority Voting
  - RPSG decision-making that will be recognized by the Transmission Provider for purposes of Attachment K shall be those authorized by a simple majority vote by then-current Sector Members
  - Voting by written proxy is allowed

RPSG Formation

- 2021 SERTP RPSG Sector Members
- 2022 SERTP RPSG Sector Members
- 2023 SERTP RPSG Sector Members

SERTP Regional Models

- SERTP will develop 6 coordinated regional models
- Models include latest transmission planning model information within the SERTP region
- Typically, 3 versions created annually
- Will be available on the Secure Area of the SERTP website.

No.	Season	Year
1	Summer	2025
2		2028
3		2033
4	Shoulder	2028
5	Winter	2028
6		2033

SERTP

Economic Planning Studies

Economic Planning Study Process

- RSPG selects the Economic Studies in the 1st Quarter Meeting
- SERTP Sponsors identify the transmission requirements needed to move large amounts of power above and beyond existing long-term, firm transmission service commitments
  - Analysis is consistent with NERC standards and company-specific planning criteria
- These studies represent analyses of hypothetical scenarios requested by the stakeholders and do not represent an actual transmission need or commitment to build
- Selected Economic Study Request Reports are posted on the SERTP Website in the General Documents section of the Reference Library tab
- Scoping Meeting typically held in April/May

RPSG Selected List of Economic Study Requests

- 2021 Economic Planning Studies
- 2022 Economic Planning Studies
- 2023 Economic Planning Studies

SERTP – Interactive Training Session

March 14th, 2023

Transfer Analysis and Bubble Diagrams

James Normansell - TVA

Introduction

- Transfer analysis is a study of the effects of a power transfer on the reliability of interconnected systems within the context of other functions performed by these systems.
- An evaluation of the ability of interconnected systems to reliably transfer power from one area to another by way of *all paths* between those areas under specified system conditions.
- Systems must always be planned to operate reliably within thermal, voltage, and stability limits.
- Planners may use transfer capability as one indicator of transmission strength in assessing system performance.
- No comprehensive and universally applicable procedure exists for determining the adequate or appropriate level of transfer capability that will ensure consistent reliable service.

Transfer Analysis Basics

- **Evaluation begins with a base case model of assumed system conditions, which incorporates dispatch projections, expected customer demands, topology, and interchange.**
- **Study requests will identify a source and sink pair, a transfer amount (MW), and a study model.**
- **Siemens PTI PSS®E and/or PowerGEM TARA (Transmission Adequacy & Reliability Assessment) are used to build the model and simulate the transfer.**
- **System performance is assessed for reliability under contingency.**
- **Study methodology adheres to NERC Reliability Standards and other applicable thermal, voltage, stability, and short circuit criteria.**

SIEMENS

PowerGEM

Power Grid Engineering & Markets

Source and Sink Pairs

- **Source is the exporting area/point at which the generation is located.**
  - Generation is increased to an appropriate dispatch within the installed capacity.
  - Customer demands may also be reduced, provided the simulated conditions are realistic.
- **Sink is the importing area/point at which the load is located.**
  - Generation is decreased on a realistic dispatch basis.
  - Reactive output should be modified for consistency with the reduced real power output levels.
- **This information is known as the type of transfer in a study request.**
- **Used in the context of source and sink, the term area refers to the configuration of network elements within the topology of an individual system.**

Measures of Reliability

- Thermal limits, in the form of ratings, establish the maximum amount of current over a specified period that can flow through an element before it sustains permanent damage from overheating or violates public safety ground clearance requirements.
- Resistive and reactive losses are experienced on systems during a transfer. Voltage limits establish the maximum amount of transfer than can occur without causing a collapse of voltage.
- Generators connected to AC systems operate in synchronism with each other. Stability limits establish the amount of oscillation that can occur on generators without losing synchronism and degrading system frequency.
- In general, most limiting constraints on peak are due to thermal limits. Voltage, stability, and short circuit studies can also reveal issues.

Planning Study Process

- Thermal, voltage, and/or stability constraints are identified through technical analysis.
- Study results are evaluated against established planning criteria.
- Further thresholds may be utilized to screen results for impacts.
- Planners develop potential solutions and then validate their effectiveness.
- Necessary enhancements are given a cost estimate and timeline for completion.
- A study report providing specific, detailed information on the required system upgrades is prepared for the requestor.

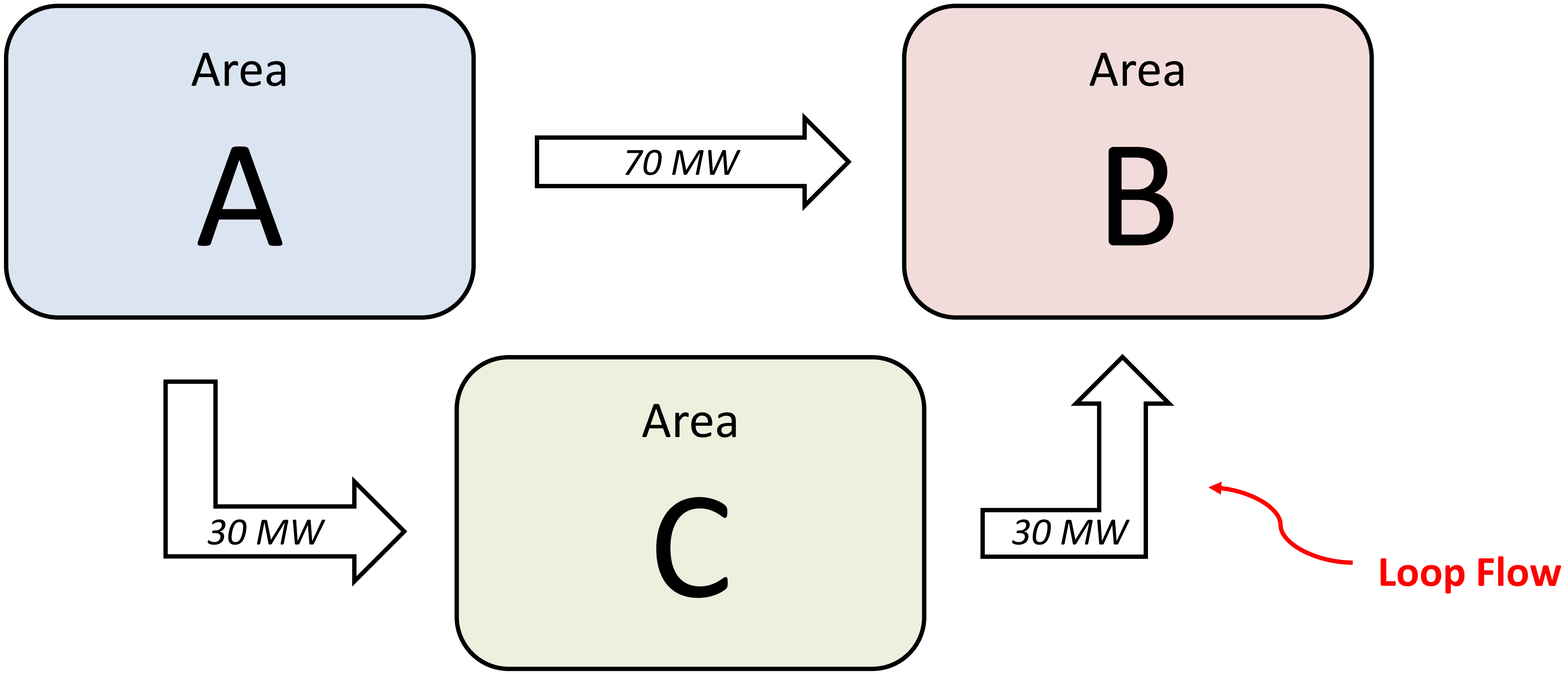
Parallel Path Flows

- **Power transfers in AC systems are distributed, in varying degrees, on all transmission paths between two areas.**
- **When a transfer between two areas distributes onto neighboring systems, the unintended consequential flows are a complex phenomenon known as parallel path flows.**
- **Parallel path flows, sometimes called loop flows, can affect many systems, especially those electrically near and between the sourcing and sinking areas.**
- **Transfer flow diagrams, also called bubble diagrams, provide visual evidence of this phenomenon.**

Affected System Studies

- Interconnection System Impact Studies evaluate the effects of a proposed interconnection on the safety and reliability of a Transmission Provider's Transmission System and, if applicable, an Affected System.
- An Affected System is an electric system other than the Transmission Provider's Transmission System that may be affected by the proposed interconnection.
- The Transmission Provider must allow any Affected System to participate in the process when conducting Interconnection System Impact Studies, and incorporate the safety and reliability needs of the Affected System.
- The Transmission Provider will coordinate the conduct of any studies required to determine the impact of the proposed interconnection on Affected Systems.

Affected Systems Example: A to B – 100 MW

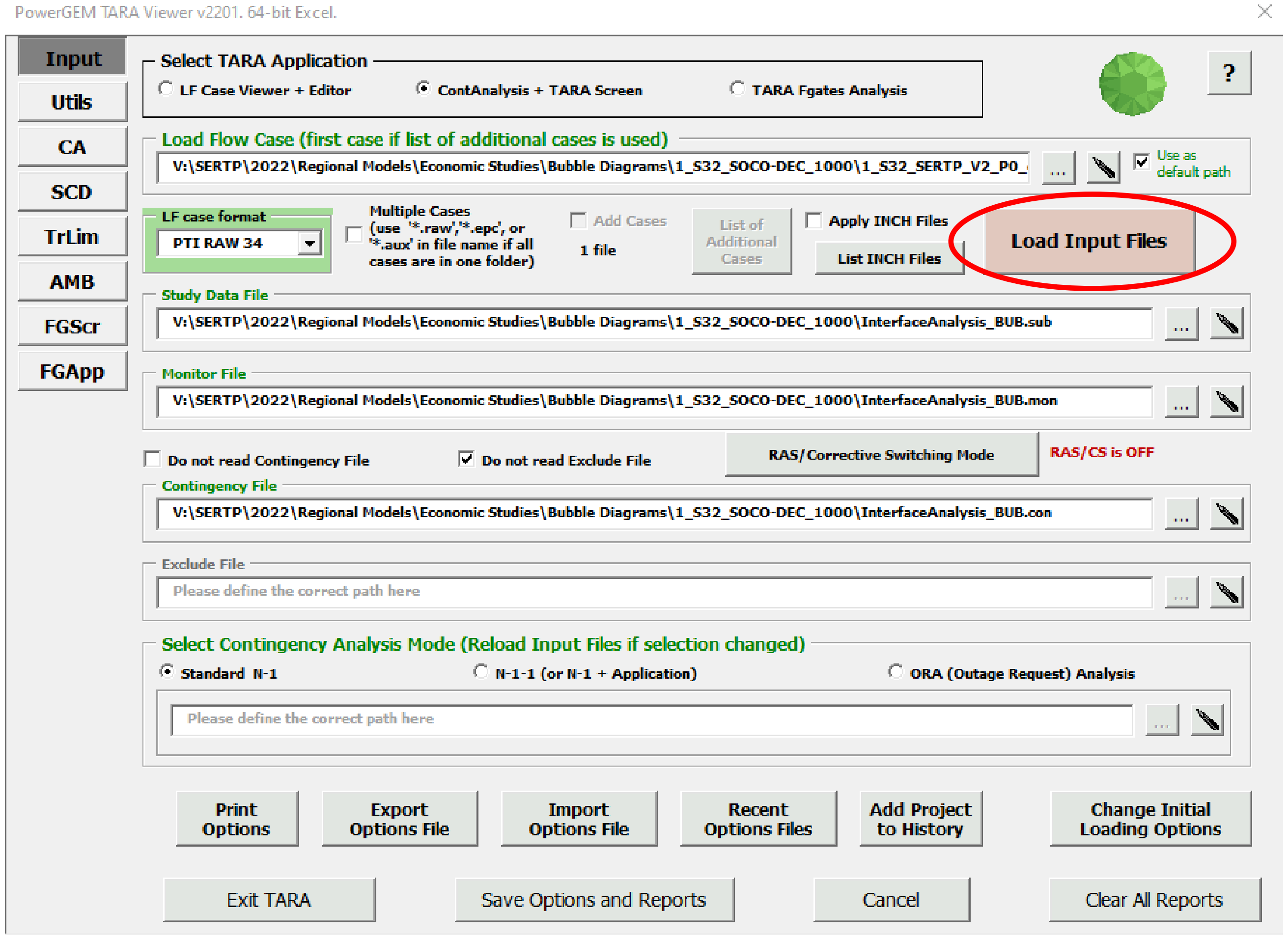


Creation of Bubble Diagrams

- This product is a feature of PowerGEM TARA.
- A python script is run on the study model in Siemens PTI PSS®E to consolidate individual load flow areas and place them into their respective bubbles.
- Important that planners first verify and validate the accuracy of all load flow areas with respect to their bubble assignments! Every area in the model must fit into a bubble.
- Generic subsystem, monitor, and contingency files are loaded, but do not actually get used in the bubble diagram application.
- Objective is to determine the flows, as a percentage of the total transfer, on the connections between bubbles.

Load Input Files

- **Select load flow case.**
  - after application of python script.
  - in .raw data file format (v34).
- **Select subsystem file.**
- **Select monitor file.**
- **Select contingency file.**
- **Click Load Input Files.**



Launch Area Diagram

- **In top ribbon, go to TARA LFCase.**
- **Click Area Diagram.**

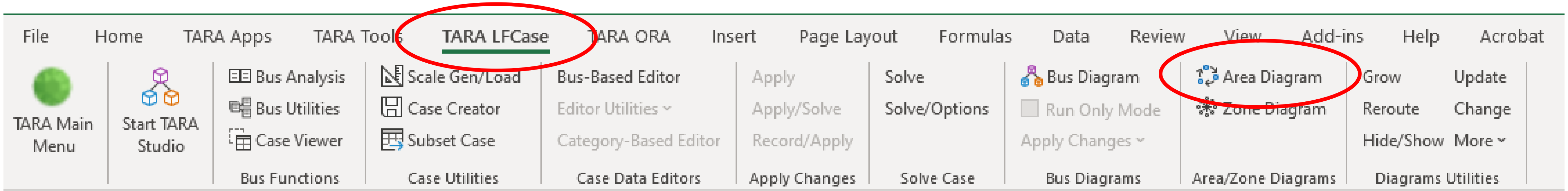
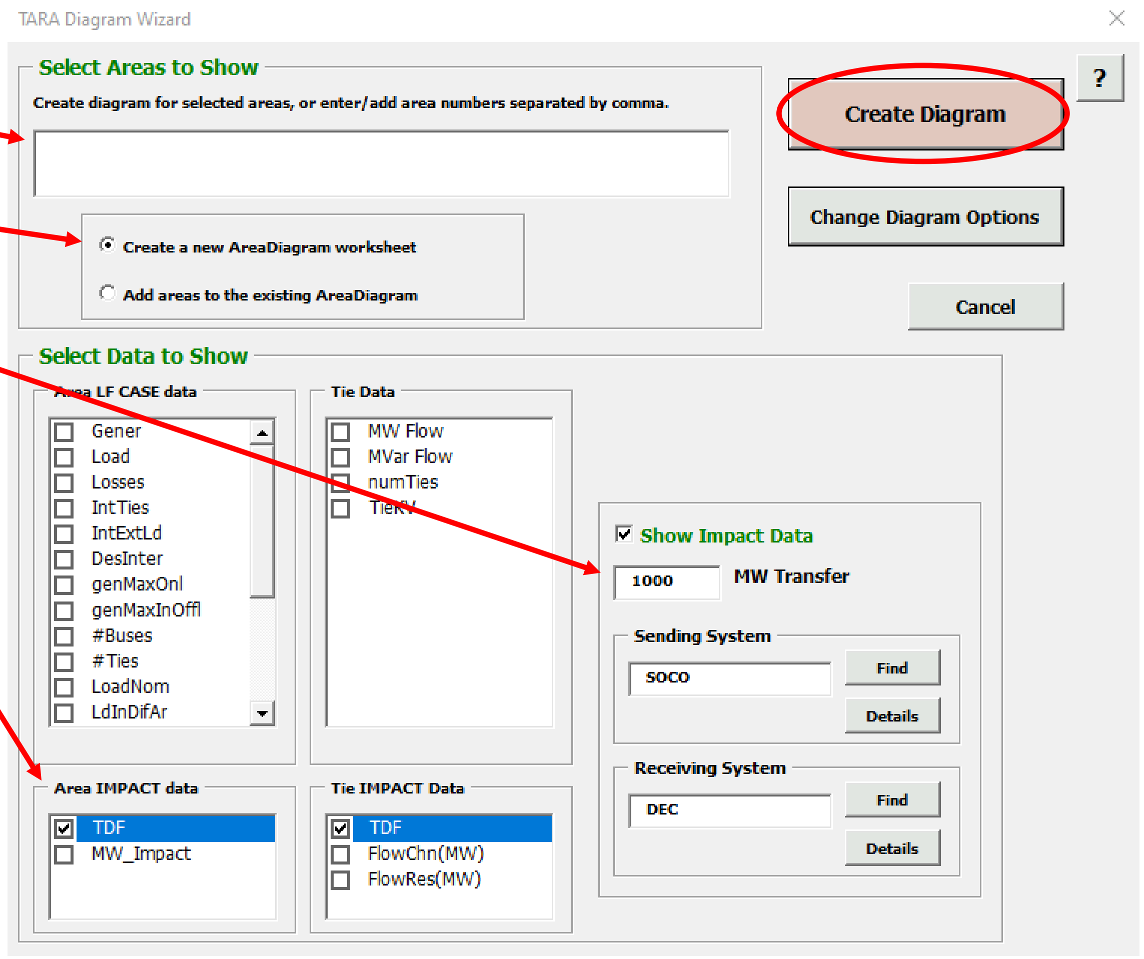


Diagram Selections

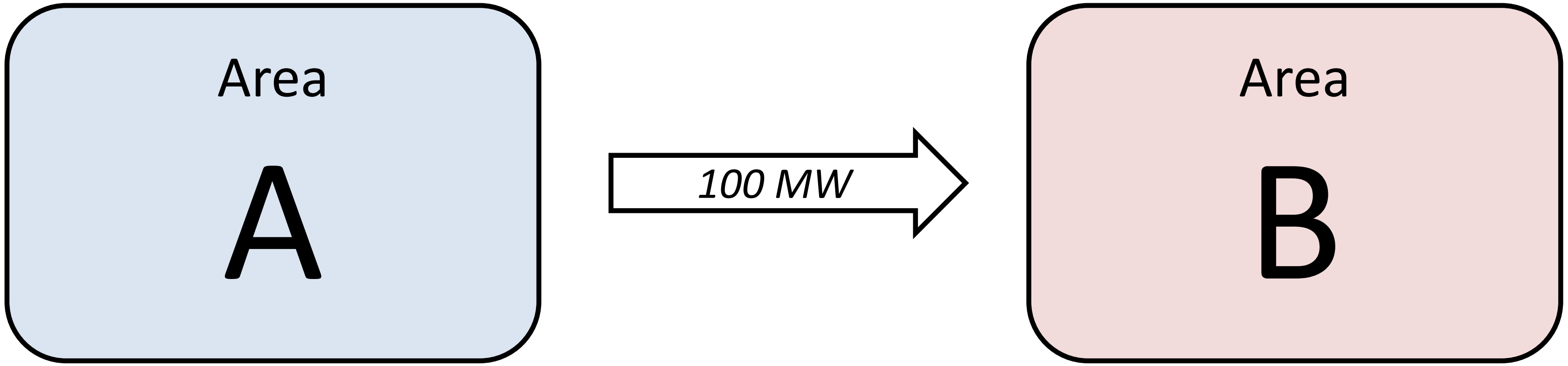
- Populate the list of area numbers that will appear in the diagram as bubbles.
- Select to create a new worksheet.
- Add MW Transfer, Source, and Sink.
- Select TDF for Area Impact data and Tie Impact data.
- Click Create Diagram.



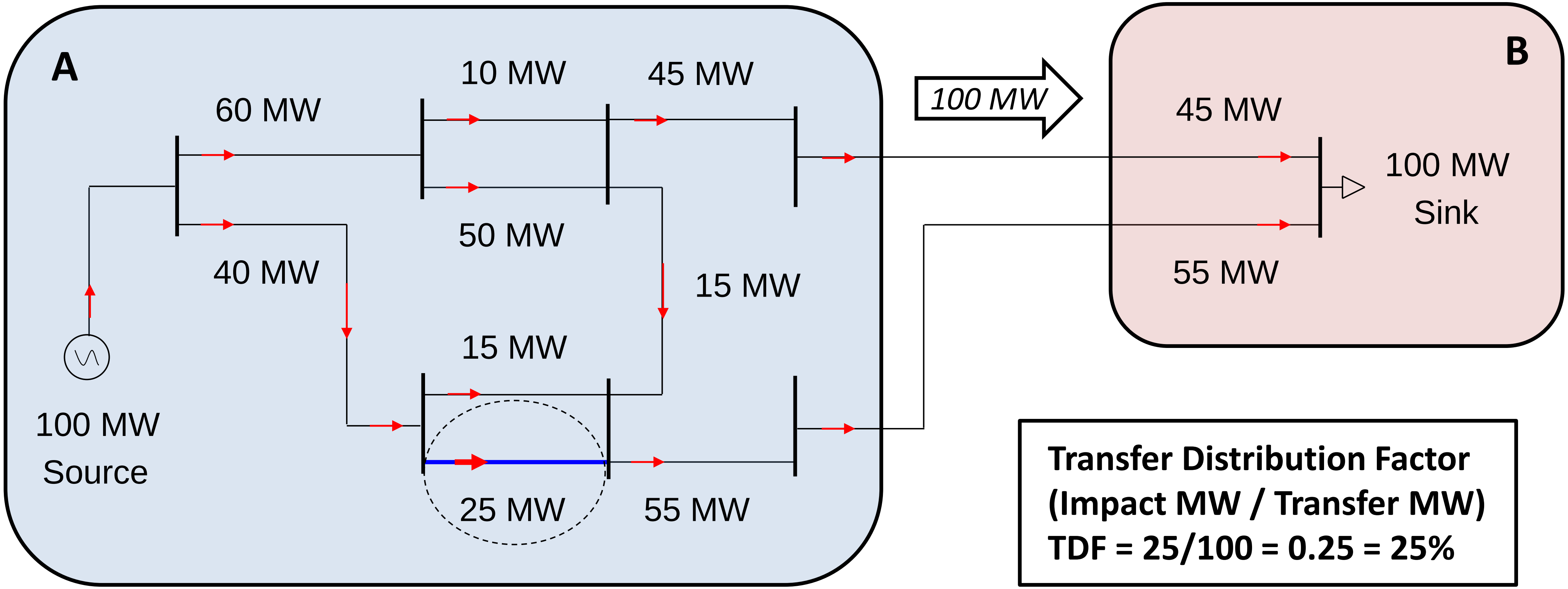
TDF is the Transfer Distribution Factor, which is a measure of a power transfer carried by a transmission element.

Transfer Distribution Factor

- A TDF value, expressed in percent, is calculated for every element in the system.
- Varying the amount of power transferred will not change the TDF value.
- Shows how a power transfer is distributed amongst transmission elements.
- Shows the level of support provided by/the impact upon each element.



TDF Example: A to B – 100 MW



Transfer Distribution Factor
(Impact MW / Transfer MW)
TDF = 25/100 = 0.25 = 25%

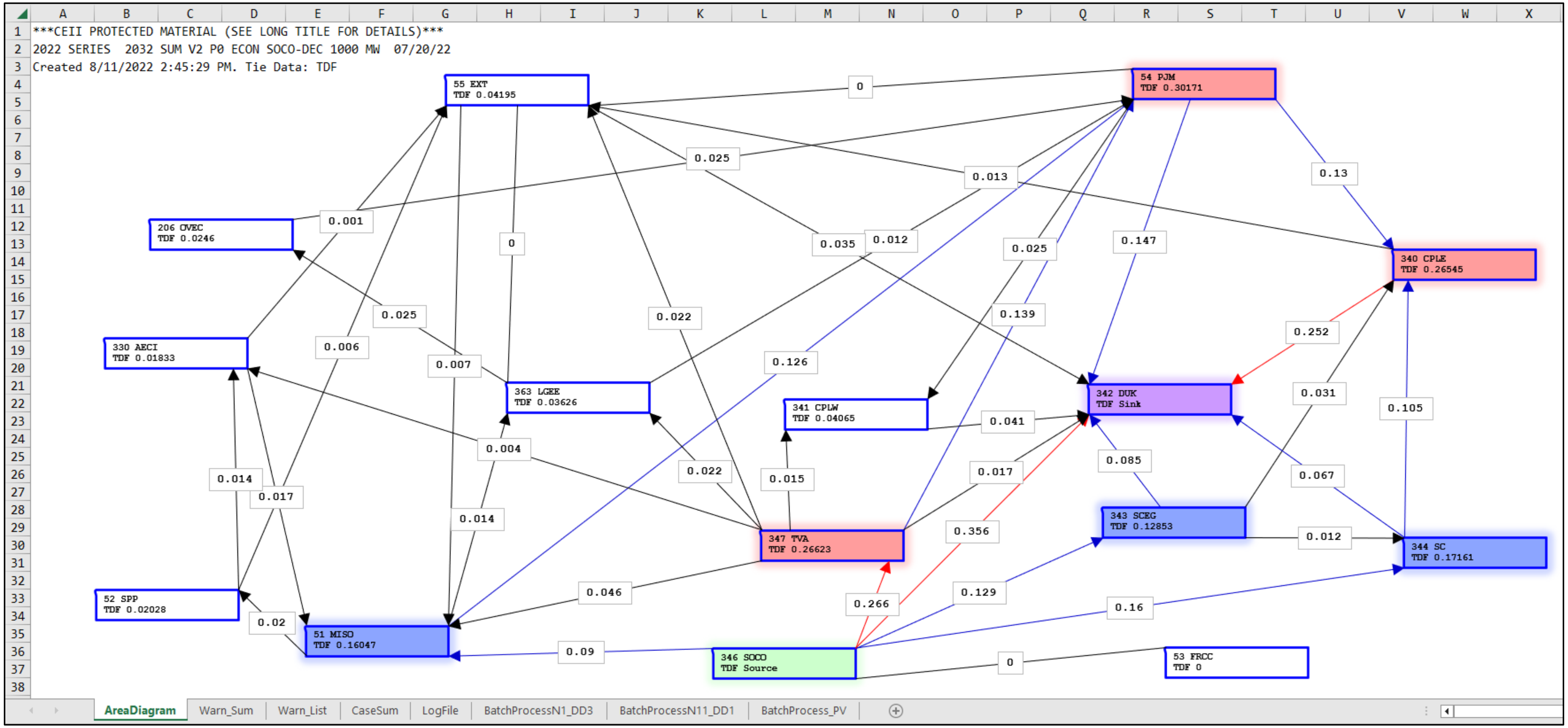
Examples of TDF Calculations

- **For a 1000 MW transfer,**
  - Line A carries 80 MW of flow without the transfer.
  - Line A carries 120 MW of flow with the full transfer.
  - The TDF for Line A is (120 MW-80 MW)/1000 MW * 100% = 4%
- **For the same 1000 MW transfer,**
  - Line B carries 40 MW of flow without the transfer.
  - Line B also carries 120 MW of flow with the full transfer.
  - The TDF for Line B is (120 MW-40 MW)/1000 MW * 100% = 8%
- **Line B has twice the response to the transfer as compared to Line A.**

Southeastern Regional TRANSMISSION PLANNING

2023 SERTP

TARA Area Diagram



Final Steps - PowerPoint

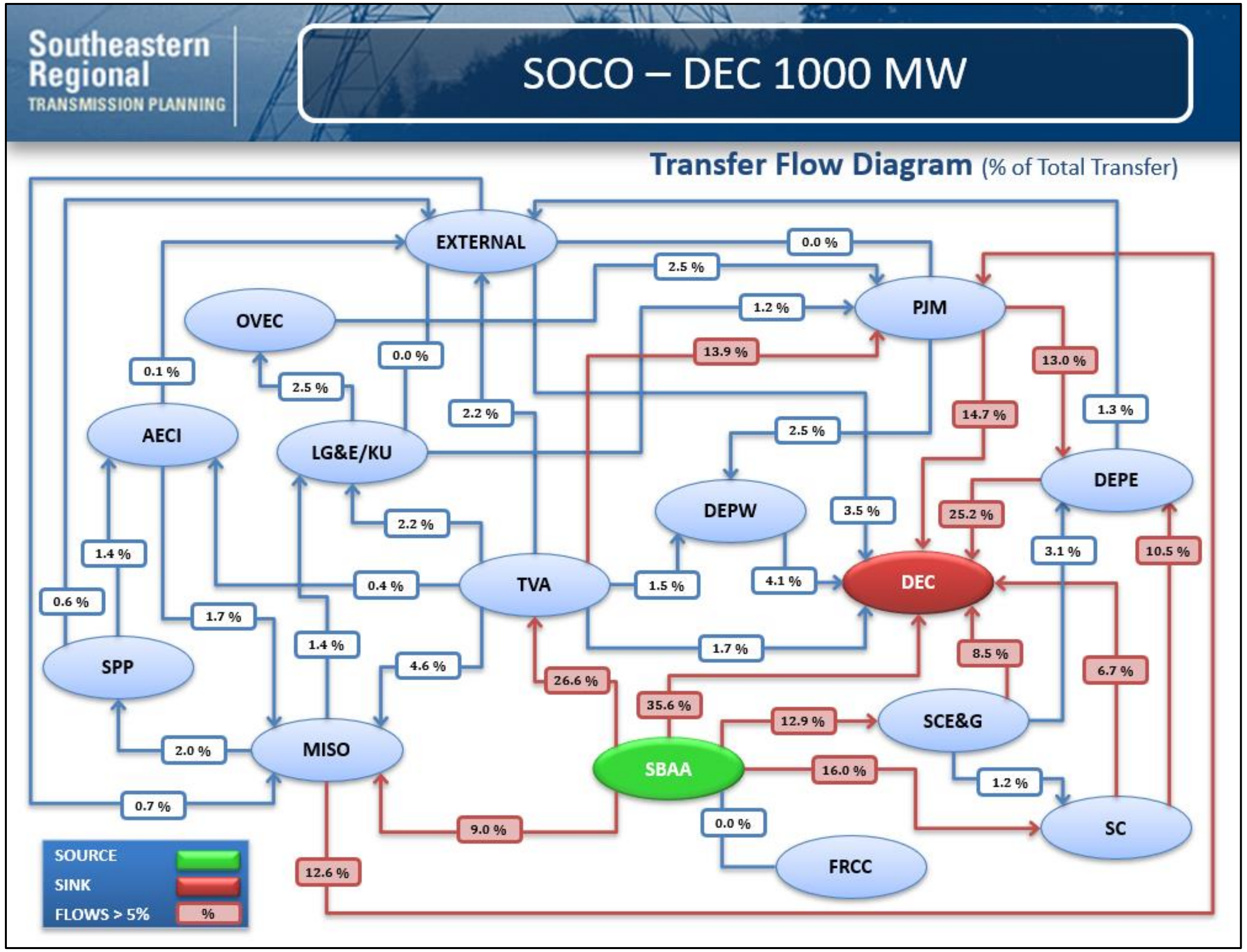
- **Position the TARA Area Diagram to align with the template.**
  - Arrange the bubbles and connections somewhat geographically.
- **Starting with the bubble diagram template:**
  - Apply green and red color to Source and Sink bubbles, respectively.
  - Populate values and indicate flow direction by applying the correct arrow.
  - Apply red color to connections when flow values are >5% impacts.
  - Verify that flows into/out of all bubbles makes sense.
- **This is a manual process and requires careful attention to detail!**

Example Scenario: SOCO to DEC – 1000 MW

- **Year: 2032**
- **Load Level: Summer Peak**
- **Type of Transfer: Generation to Generation**
- **Source: Generation within SOCO**
- **Sink: Generation within DEC**

Example Scenario: SOCO to DEC – 1000 MW

- Green bubble indicates the Source.
- Red bubble indicates the Sink.
- Flows out of Source equals +100%.
- Flows into Sink equals -100%.
- Flows into/out of other bubbles sums to 0.
- Flows in red are >5% impacts.
- Arrows indicate direction of flow.
- Parallel path flows are clearly visible.



Questions?

www.southeasternrtp.com

SERTP

Public Policy Requirements Stakeholder Proposal

SERTP Evaluation

Transmission Needs Driven by Public Policy Requirements (PPRs)

- The SERTP process received <u>three</u> submissions for needs driven by Public Policy Requirements. These submissions are all related to the North Carolina Carbon Plan. They are being reviewed by the SERTP Sponsors for evaluation and will be addressed at the 2nd Quarter SERTP Meeting.

Coordination Activities with Transmission Providers

- **The SBAA (specifically Southern Company, GTC and MEAG) are currently evaluating the possibility of adding new transmission tie lines with South Carolina**
  - There are multiple possible lines that are being evaluated to determine benefits on both sides of the interface
  - If a candidate line is determined to be beneficial and approved for construction by the companies involved, the expansion plans will be modified to reflect the addition

Next Meeting Activities

- **2023 Economic Planning Study Scoping Meeting**
  - **Date: TBD**
  - **Held Virtual**
  - **Purpose:**
    - Review Study Assumptions for each Selected Economic Planning Study
    - RPSG Input & Feedback for Study Assumptions

- **2023 SERTP 2nd Quarter Meeting**
  - **Date: June 29th, 2023**
  - **Hosted by TVA in Chattanooga, TN**
  - **Purpose:**
    - Review Modeling Assumptions
    - Discuss Preliminary 10 Year Expansion Plan
    - Stakeholder Input & Feedback Regarding the Plan
    - Public Policy Requirement Evaluation Results

Questions?

www.southeasternrtp.com