

**NERC**

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

# Industry Webinar

Project 2010-13.2 Phase 2 of Relay Loadability

May 15, 2013

**RELIABILITY | ACCOUNTABILITY**



- Welcome, Introductions and Administrative
- NERC Antitrust Guidelines
- Opening remarks
- Project background
- Bright line between the loadability standards
- Incremental changes since last posting
- Project going forward

- BES – Bulk Electric System
- kV – kilo-Volts
- GO – Generator Owner
- GSU – Generator Step-up
- IEEE – Institute of Electrical and Electronics Engineers
- MVA – megavoltampere
- Mvar – megavoltampere-reactive
- MW – megawatts
- PC – Planning Coordinator
- RRO – Regional Reliability Organization
- TP – Transmission Planner

- Standard Drafting Team
  - Charlie Rogers, Chair, Consumers Energy
  - Mike Jensen, Member, Pacific Gas & Electric Company
- NERC Staff
  - Scott Barfield-McGinnis, Standards Developer
  - Phil Tatro, Technical Advisor

Member	Registered Entity
Charles W. Rogers, Chair	Consumers Energy
Jeff Billo	ERCOT
S. Bryan Burch, P.E.	Southern Company
Steven Hataway	Florida Power and Light Company
Jonathan Hayes	Southwest Power Pool, Inc.
Mike Jensen	Pacific Gas and Electric Company
Xiaodong Sun	Ontario Power Generation, Inc.
Sudhir Thakur	Exelon Generation
Joe T. Uchiyama	U.S. Bureau of Reclamation
Benson Vuong	Salt River Project
David Youngblood	Luminant Energy

- Informal Question and Answer (Q&A) session during the second half
  - Q&A session is intended to improve overall understanding
  - Submit questions and comments via the chat feature
  - Please reference slide number, standard section, etc.
  - Presenters will attempt to address each question
  - Some questions may require later SDT consideration
  - Session is intended to provide better understanding
- Comments for the official record
  - Submit during open comment periods
  - Chat comments are not a part of the project record

- NERC Antitrust Guidelines
  - It is NERC's policy and practice to obey the antitrust laws and to avoid all conduct that unreasonably restrains competition. This policy requires the avoidance of any conduct that violates, or that might appear to violate, the antitrust laws. Among other things, the antitrust laws forbid any agreement between or among competitors regarding prices, availability of service, product design, terms of sale, division of markets, allocation of customers or any other activity that unreasonably restrains competition. It is the responsibility of every NERC participant and employee who may in any way affect NERC's compliance with the antitrust laws to carry out this commitment.

- **Disclaimer**
  - Participants are reminded that this meeting is public. Notice of the meeting was posted on the NERC website and widely distributed. The notice included the number for dial-in participation. Participants should keep in mind that the audience may include members of the press and representatives of various governmental authorities, in addition to the expected participation by industry stakeholders.
  - Wording in this presentation is used for illustrative purposes and may not reflect the official draft of the posted standard



- Today's important takeaways
  - Bright line between the proposed standard(s)
    - Applicability
  - Specific changes to PRC-023-3
    - PRC-023-3 – R7, R8, and Attachment C – Table 1
  - Incremental changes to PRC-025-1
    - Clarifications
    - New Calculations
    - Implementation
  - Going forward
    - Comment Period (April 25, 2013 – May 24, 2013)
    - PRC-023-3 and PRC-025-1

- FERC Order No. 733
  - PRC-023-1 Transmission Relay Loadability (Phase 1)
    - Directed modifications implemented in PRC-023-2
  - PRC-025-1 Generator Relay Loadability (Phase 2)
    - “...develop a new Reliability Standard addressing generator relay loadability, with its own individual timeline, and not a revision to an existing Standard.” (P106)
  - Protective Relay Loadability due to Stable Power Swings (Phase 3)
    - “...develop a Reliability Standard that requires use of protective relay systems that can differentiate between faults and stable power swings and, when necessary, phases out protective relays that cannot meet this requirement.”(P130)

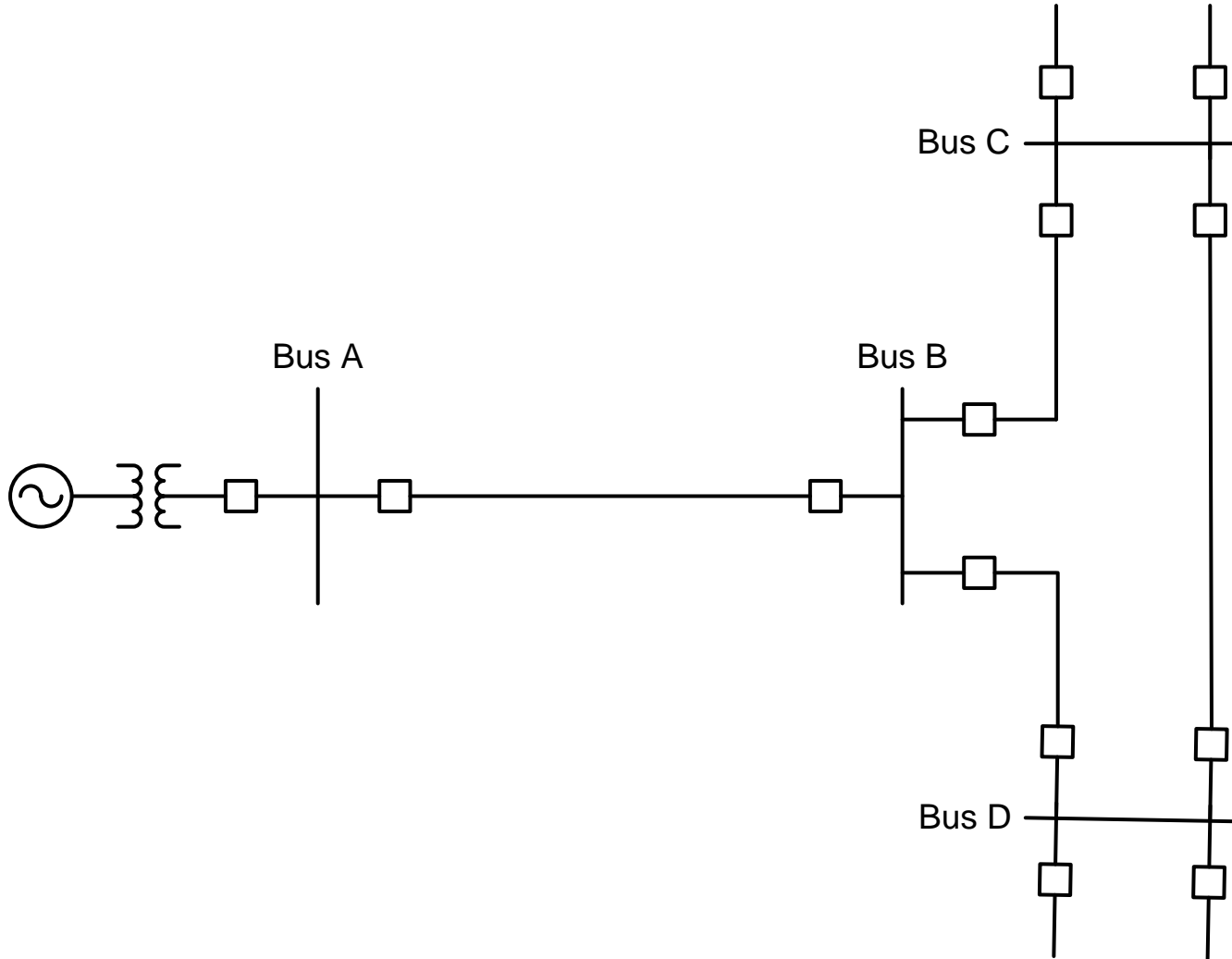


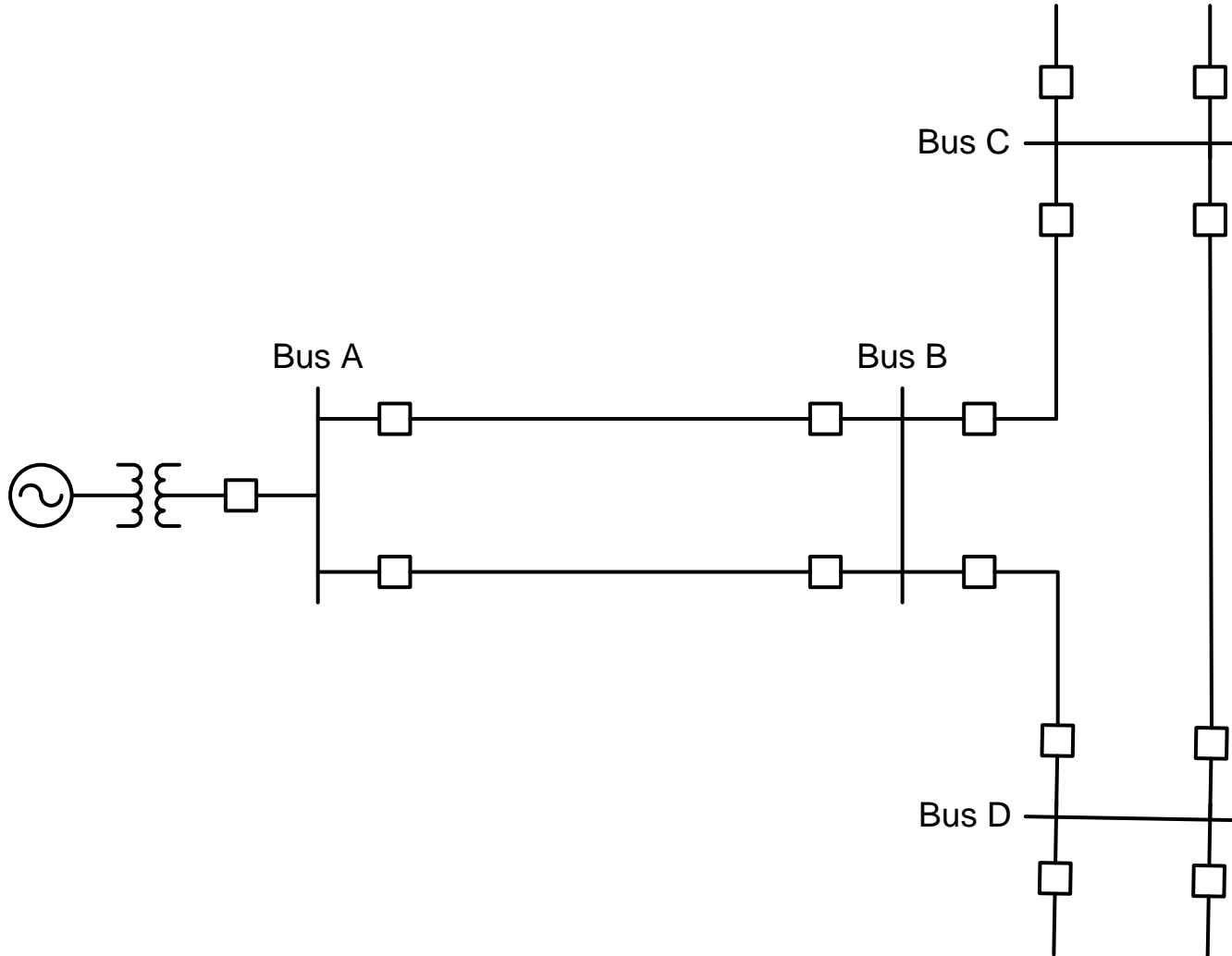
# Bright line between standards

- Applicability – What applies to which standard
- All BES generators
- Commonality
  - Equivalent Requirements for similar Facilities regardless of who owns the equipment
- New Requirements in PRC-023-3 for DP and TO
  - R7 for generator interconnection Facilities
  - R8 for GSU transformers
  - Attachment C, Table 1

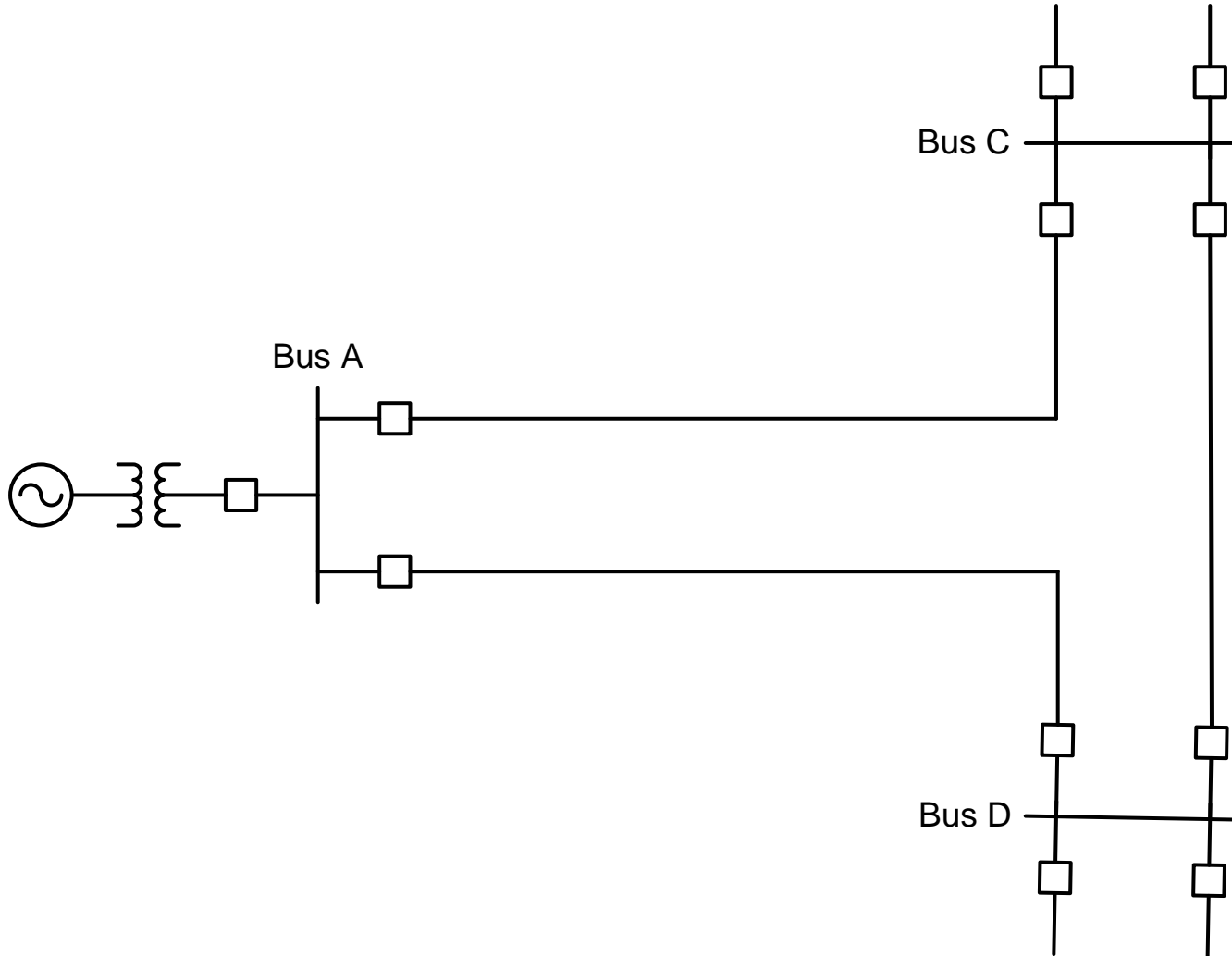
- PRC-023-3
  - “4.1.1. Transmission Owner with load-responsive phase protection systems as described in PRC-023-3 - Attachment A, applied at the terminals of the circuits defined in 4.2.1, 4.2.3, or 4.2.4 (*Circuits Subject to Requirements R1 – R5, R7, and R8*).”
  - “4.1.2. *Generation Owner...*” (*no change in performance*)
  - “4.1.3. Distribution Provider with load-responsive phase protection systems as described in PRC-023-3 - Attachment A, applied at the terminals of the circuits defined in 4.2.1, 4.2.3, or 4.2.4 (*Circuits Subject to Requirements R1 – R5, R7, and R8*), provided those circuits have bi-directional flow capabilities.”

- 4.2.3 Circuits Subject to Requirement R7
  - “4.2.3.1 Transmission lines that are used solely to export energy directly from a BES generating unit or generating plant to the network.”
- 4.2.4 Circuits Subject to Requirement R8
  - “4.2.4.1 Transformers with low voltage terminals connected below 200 kV, including generator step-up transformers, that are used solely to export energy directly from a BES generating unit or generating plant to the network.”
- No voltage differentiation for BES generating units or generating plants









- PRC-023-3, R1
  - “Each Transmission Owner, Generator Owner, and Distribution Provider shall use any one of the following criteria (Requirement R1, criteria 1 through 13) for any specific circuit terminal to prevent its phase protective relay settings from limiting transmission system loadability while maintaining reliable protection of the BES for all fault conditions. Each Transmission Owner, Generator Owner, and Distribution Provider shall evaluate relay loadability at **0.85 per unit voltage** and a power factor angle of 30 degrees. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*”
- R1, Criterion 6 (i.e., lines connecting generation)

- PRC-023-3
  - “R7. Each Transmission Owner and Distribution Provider shall set their load responsive relays in accordance with PRC-023-3, Attachment C at the terminals of the **generator interconnection Facility**. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning].*”
  - “R8. Transmission Owner and Distribution Provider shall set their load responsive relays in accordance with PRC-023-3, Attachment C at the terminals of the **generator step-up transformer**. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning].*”

- PRC-023-3 mimics PRC-025-1, Attachment 1, Table 1
  - Relevant PRC-025-1 discussion
  - Relevant Transmission system detail
  - Specific exclusions
  - Options applicable to the DP and TO (Table 1)
    - Generator interconnection Facility(ies)
    - GSU transformers
- Aligns the performance between the standards
  - Avoids preferential treatment between standards
  - Language achieves a consistent objective for all functions

- R1, Criterion 6 eliminated (replaced by R7 and R8)
- Attachment A
  - ~~2.4. Generator protection relays that are susceptible to load.~~ 2.4. Protective relays applied at the terminals of generation Facilities in accordance with NERC Reliability Standard PRC-025-1 or its successor(s).
- New Attachment C
  - Application details
  - Table 1, Options
- Replaced Implementation Plan (R7 and R8 comport with PRC-025-1 implementation periods)



# Incremental changes to PRC-025-1

- Purpose
  - Revised to better reflect the intent of the standard
  - “To set load-responsive protective relays associated with generation Facilities at a level to prevent unnecessary tripping of generators during a system disturbance for conditions that do not pose a risk of damage.”
- Applicability
  - Clarified Elements associated with generating units and generating plants
  - “3.2.5 Elements utilized in the aggregation of dispersed power producing resources.”

- General Enhancements
  - Note that standard does not require relay installation
  - Replaced PC with the RRO to address MOD-025-2 standard
  - Updated GSU tap acronyms to IEEE (e.g., DETC and LTC)
  - Co-located synchronous and asynchronous generation
  - Multi-winding GSU transformer
- Exceptions for load-responsive protective relays
  - Protection systems that designed to coordinate with the generator short time capability
  - Protection systems that detect transformer overloads and allow an operator 15 minutes or greater to respond



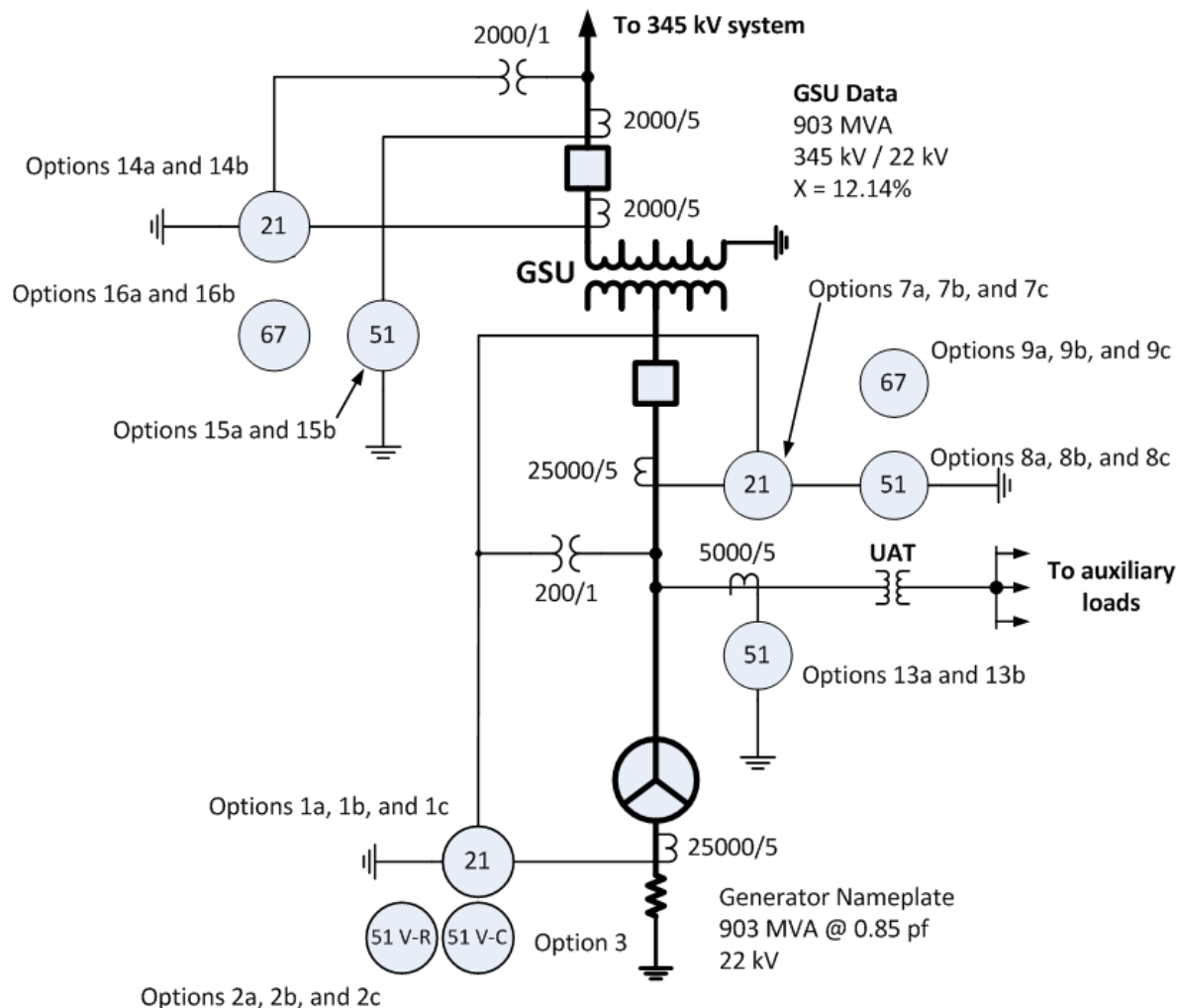
- Enhancements
  - Removed PC and added reference to RRO
  - Corrected technical language about simulation
    - Clarified the bus voltage being used
    - Voltage coincident with the highest Reactive Power output
  - Inserted “gross” for clarification (e.g., gross MW)
  - Clarified the location of the relay
  - Replaced the dash in the Application column with “connected to”
  - Removed Option 11b – duplication of Option 18
  - Generator interconnection Facilities – changed 150% to 120%

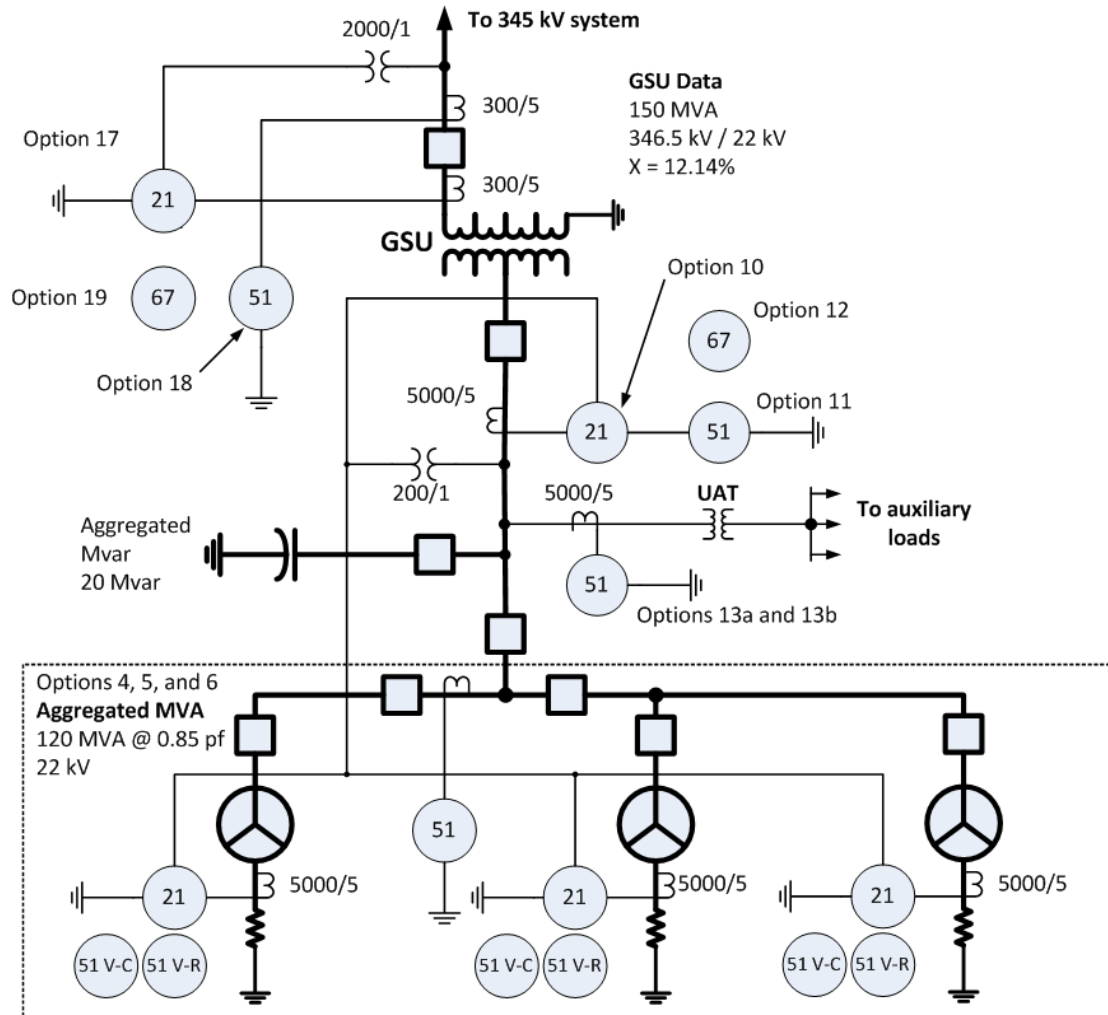


# Guidelines and Technical Basis

- **Introductory discussion**
  - Clarified use of simulation
  - Clarified “output” to be explicit – “Real Power output”
  - Figures 1, 2, and 3 (Transmission system)
  - Figures 4 and 5 (relay location)
- **Options discussion**
  - Narrative revised to coincide with Table 1 revisions
  - Replaced PC with RRO language
  - Capitalized NERC glossary terms
  - Minor consistency corrections

- Additional example calculations
  - Made  $P_{\text{reported}}$  and  $P_{\text{nameplate}}$  different
  - Simulation, including sample plot
  - Sync and Async configurations (vector summing)
  - Mathematical and syntax errors corrected
  - Various Options were moved and combined
  - Modified example equations for Options 14a, 15a, and 16a to account for 1.2 p.u. MW multiplier factor for CT/PTs on high voltage side of GSU transformers.





A photograph showing a person's hands holding a blue pen and a stack of papers. The image is overlaid with a semi-transparent map of North America. The map is light blue and shows the outlines of the United States, Canada, and Mexico. The photograph is slightly blurred, giving it a professional and busy feel.

# Implementation

- Draft 3 proposal – Same phased approach
  - 48 months for calculations (implicit)
    - Required to determine if settings can be applied to existing protection systems, or
    - if protection systems requires replacement
  - 48 months for applying settings (existing)
  - 72 months for applying settings (replacements/retirements)
    - Where there is no alternative to replacement
- Clarifying revision
  - Included relay retirement provision
  - Same 48/72 months for relay inclusion not caused by GO
  - Periods listed in table format like PRC-023-3



- **Transmission Relay Loadability (PRC-023-3)**
  - First formal posting
  - SDT respond to comments
  - Initial ballot and comment period (July 2013)\*
- **Generator Relay Loadability (PRC-025-1)**
  - Successive ballot and comment posting
  - Potential recirculation (June 2013)\*
  - Board of Trustees adoption (August 2013)\*

\*Dates are tentative

- Effective feedback:
  - Specific to question, brevity is best
  - Provide suggestions or alternative approaches
  - Indicating agreement with others is preferred over copying the comments (e.g., “ABC agrees with XYZ’s comments...” or “ABC agrees with XYZ’s comments except for...”) Provide proposed change and rationale
- Less effective feedback:
  - Repeating same comment multiple times
  - No reference to where suggested change should occur
  - Non-specific concerns (e.g., “This change is not needed.”)



# Questions and Answers

- Please submit your questions via the chat window
  - This session is intended to help general understanding
  - Please reference slide number, standard section, etc.
  - Presenters will respond to as many as possible
  - Some questions may have to be deferred to the team
- Comments for the official record
  - Comments must be submitted via the project page during the open comment period (**ends at 8:00 p.m. ET on Friday, May 24, 2013**)
  - Webinar and chat comments are not a part of the official project record

- NERC Standard Developer, Scott Barfield-McGinnis
  - Email at [scott.barfield@nerc.net](mailto:scott.barfield@nerc.net)
  - Telephone: 404-446-9689
  - To receive project announcements and updates
    - Request to be added to GENRLOSDT\_Plus
  - For more information on Phase III – Stable Power Swings
- Timeline
  - 30-day comment period – **ends May 24, 2013 – 8:00 p.m. ET**
    - Both PRC-023-3 and PRC-025-1
  - Successive Ballot in the last ten days of comment period
    - PRC-025-1 Only