



Survey on Protection System Practices for IBR Negative-Sequence Current Injection Implementation

SPWG

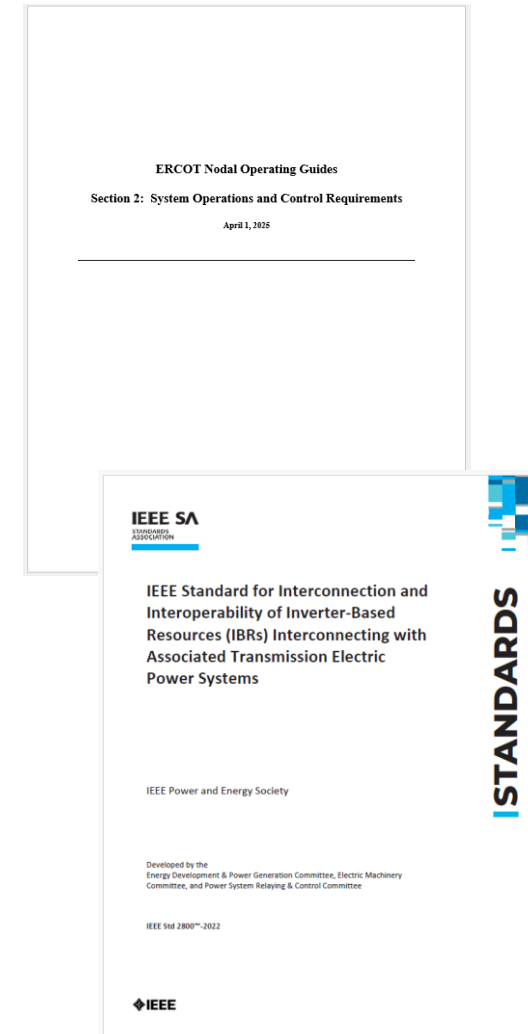
November 12, 2025

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Background

- NOGRR 245 adopts IEEE Std. 2800
 - Section 5, Reactive power-voltage control requirements within the continuous operation region;
 - Section 7, Response to TS abnormal conditions; and
 - Section 9, Protection.
- Negative-sequence current injection (NSCI) during unbalanced faults is required through the Clause 7.2.2.3.4. Current injection during ride-through mode in IEEE Std. 2800
- IBR projects with an SGIA executed on or after August 1, 2024 or that implements a modification shall ensure NSCI capable and meet the minimum performance requirement set in the standard
- IEEE Std.2800 intentionally does not specify detail performance. The TS owner should consider specifying the requirement, like magnitude of incremental positive and negative sequence reactive currents during faults per respective system needs



Survey with TSPs on NSCI

- Without clear guidance, IBRs may inject NSCI in ways that may not align with existing protection schemes.
- Goal:
Support a coordinated approach to improving system protection coordination and ensuring consistent IBR performance across the grid while maintaining system reliability and resilience.
- Main Objectives:
 1. Current protection practices for transmission systems with IBR integration,
 2. Expected impacts and necessary adjustments to major protection functions resulting from the enablement of NSCI,
 3. Associated acceptable levels and response characteristics of NSCI required for mandatory IBR control performance during fault conditions to satisfy system protection requirements, and
 4. Recommendations on new processes, models, and data submission requirements with respect to NSCI from IBRs.

Selected Survey Questions

- Question:
 - (a) What types of protection elements, such as overcurrent, directional, distance protection, or others, are most commonly used today for transmission lines or equipment connected to IBRs?
 - (b) How do you approach protection element selection and settings for transmission lines with different levels of IBR penetration (both high and low), assuming no NSCI from IBRs?
- Question:
 - (a) From a system protection perspective, do you recommend specific characteristics for IBR NSCI when configuring transmission protection?
 - (b) If so, please provide recommendations regarding acceptable levels and response characteristics during unbalanced faults (e.g., response speed, injection duration, magnitude in p.u. of incremental or absolute NSCI, and the phase angle relationship between negative-sequence voltage (V_2) and current (I_2)).
- Question:

Do you expect any changes to fault clearing times with the implementation of NSCI in IBRs?
- Question:

What additional modelling data and information would you need to incorporate NSCI into short-circuit models in order to accurately replicate IBR behavior observed in the field?

Next Steps

- Distribute the survey to each utility's SPWG representative, who will coordinate with internal SMEs to provide consolidated feedback and serve as the point of contact for the survey.
- Survey responses due by **December 3, 2025** (three weeks after distribution).
- Compile and analyze all feedback to identify common themes, concerns, and areas for improvement.
- Address system protection-related issues and ensure NSCI performance requirements not compromising system stability.
- Collaborate with IBRWG and engage with IBR developers to support practical and coordinated implementation.
- For questions or feedback regarding the survey, please contact Jimmy.Zhang@ercot.com