ENERGY COMPLIANCE, INC. | *Field Reference for Reliability Engineering*

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IBR Compliance: Registration & Performance

Registration triggers, ongoing obligations, and compliance program design for IBR operators.

Most IBR compliance trouble starts after commercial operation, when the development team moves on and the obligations stay. This reference covers what triggers registration, including the Category 2 criteria, what the IBR standards now require, and how to build a program that scales.

Energy Compliance, Inc. Professional Reference

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Foreword

This professional reference is one of a series Energy Compliance, Inc. publishes for registered entities and the people who run their compliance programs.

I have spent more than thirty years on every side of the bulk electric system. I have operated control centers as a Reliability Coordinator, Transmission Operator, and Power System Operator. I have audited grid facilities and signed off on findings as a senior compliance auditor. I have worked enforcement matters from inside the regulator's process. For the last several years I have advised registered entities directly through the firm I founded.

The entities that do reliability well share a common habit. They take the standards seriously without confusing them with reliability itself. They know that a NERC Reliability Standard is a floor, not a ceiling. They know that compliance is something an auditor evaluates, while reliability is something a system either delivers or does not. They prepare for audits by building programs that survive real questions, not binders that look thick.

That is the perspective these references try to share. Each one focuses on a single topic: a standard family, an operational function, a regulatory framework, or an emerging industry challenge. Each one walks through how the topic actually works.

These references are written for the compliance manager who wants to understand the system, not just memorize requirements. For the legal counsel who has to brief a board

honestly. For the senior operator who has been told that compliance and reliability are the same thing and suspects they are not. And for the new compliance hire who got handed a binder and told good luck.

These references are not marketing material disguised as content. They are the result of three decades of doing this work and watching it succeed and fail. I have written them in the same voice I use in a control room or in front of a Regional Entity audit team: direct, grounded in evidence, and honest about what the standards do and do not require.

Energy Compliance exists because much of the consulting offered to registered entities today is structured for billable hours rather than for outcomes. Every engagement is overseen by a senior practitioner. We do not bring five people to a meeting that needs one. We automate the work that should be automated, and we apply senior judgment to the work that requires it. If that approach matches what you are looking for in a compliance partner, the back of this reference has our contact information.

Rob Smith

Founder and Principal, Energy Compliance, Inc.

Executive Summary

The generation mix on the North American grid is changing. Solar, wind, and battery storage, all connected through inverters, make up a large and growing share of interconnected capacity. The regulatory framework was built around synchronous machines, and it has been catching up. For IBR developers, owners, and operators, parts of the compliance picture are settled and parts are still moving.

Much of it has settled since this paper was first written. NERC's revised registry criteria brought non-BES inverter-based resources of 20 MVA or more, connected at 60 kV or above, onto the Compliance Registry as Category 2 Generator Owners and Generator Operators, with an effective registration date of May 15, 2026. MOD-026-2 (model verification and validation) became effective April 1, 2026. PRC-029-2 (IBR ride-through) and PRC-030-1 (unexpected IBR event mitigation) became effective October 1, 2026. Most other GO and GOP standards still need modification before they reach Category 2 facilities, and NERC is working through them.

The points this reference makes, chapter by chapter:

- **Registration is not optional for entities that meet the criteria.** It is also not self-executing for entities approaching them.
- **Registration is a one-way door.** Leaving the registry takes a Deactivation request and a basis for it, and your compliance history stays behind.
- **From the day your registration and the applicable standards are both in effect, every standard that applies to the function applies to the facility,** in real time, every day.
- **A common IBR compliance failure: assuming OEM-provided protection settings meet the standards.** Sometimes they do not, and the Generator Owner is accountable for checking.
- **A model is not a one-time submittal.** Under MOD-026-2, once its R4 applies on April 1, 2029, a setting or firmware change that alters dynamic response starts a 180-day clock.
- **One IBR project is a compliance task. Twenty projects is a compliance program.** The transition is structural, not linear.

1 Understanding IBR Technology from a Reliability Compliance Perspective

The compliance obligations that apply to an inverter-based resource are shaped by more than its capacity and interconnection point. They are shaped by how it responds to grid conditions, what reliability functions it performs, and how its behavior under stress differs from conventional synchronous generation. Understanding those characteristics is the starting point for understanding which obligations apply.

1.1 How Inverters Change the Grid's Reliability Profile

Conventional synchronous generators are mechanically coupled to the grid. Their inertial response to a frequency disturbance, the automatic release of stored rotational energy when system frequency drops, is instantaneous and physics-driven. It needs no control signal and no operator action. That inertial response has been the first buffer against rapid frequency excursions for as long as interconnected grids have existed.

Inverter-based resources connect to the grid through power electronics. Their response to frequency disturbances is governed by control settings, not physical inertia. They can be programmed to provide fast frequency response, but only if the settings are configured to do it, and only within the limits of available energy or power. A solar plant that has run at full available output all afternoon may have no headroom for frequency response at the moment a large generator trips.

That difference, physics-driven response against control-driven response, sits at the core of the reliability concerns behind NERC's IBR standards work. It is also why IBR compliance obligations now center on control settings, dynamic models, and performance verification in ways that never applied to conventional generation.

1.2 The Aggregation Effect and Why It Matters for Compliance

Individual inverter-based resources behave fairly predictably. Large groups of them, programmed with similar settings, exposed to the same weather, and connected to the same transmission regions, can behave in ways that create system-wide risk. The most visible form of that risk is a large block of IBR capacity tripping or cutting output at once in response to a single fault, at the exact moment the grid most needs generation to stay online.

NERC has documented this behavior repeatedly. The Blue Cut Fire disturbance in Southern California on August 16, 2016 produced roughly 1,200 MW of fault-induced solar output interruption. In the Odessa disturbance of May 9, 2021, a single fault at a combined-cycle plant

was followed by 1,112 MW of solar PV output reduction across plants as far as 200 miles away, and NERC and Texas RE found that none of the affected IBRs tripped because of the fault itself. Every reduction came from inverter-level or feeder-level tripping or control behavior inside the plants. In its May 2025 Level 3 Alert, NERC reported analyzing major events since 2016 totaling more than 15,000 MW of unexpected generation reduction.

That record is why ride-through performance and dynamic model validation became central compliance obligations for IBR owners and operators rather than optional engineering considerations.

1.3 Distributed vs. Utility-Scale: The Compliance Divide

Not every IBR carries the same obligations. The framework draws a real distinction between resources that are part of the Bulk Electric System or meet the Category 2 registry criteria, and distributed resources connected at distribution voltages to serve local load. That distinction drives both registration and requirement applicability.

Facilities that meet the BES definition, or the Category 2 criteria described in Chapter 2, are registered as Generator Owners and Generator Operators and must comply with the standards that apply to their category. Distributed resources below those criteria are generally outside mandatory NERC registration. Their aggregate behavior can still affect bulk system reliability, but the response to that effect runs through distribution utilities, planning processes, and interconnection requirements rather than individual registration.

The line is not always obvious, particularly for mid-sized plants whose collector systems and interconnection arrangements do not fit a simple picture. Get the determination right before commercial operation. Chapter 2 explains why the consequences of getting it wrong are different from what many developers assume.

1.4 End-of-Chapter Summary

IBR compliance begins with understanding how inverter-based technology differs from the synchronous generation the framework was built around. The standards do not treat IBRs as a different species, but the operating characteristics that drive the obligations are genuinely different. The aggregation effect, ride-through behavior, and the line between registered and distributed resources are the technical concepts that decide which obligations apply and how they show up in practice.

> **From the Field**
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> An IBR's compliance footprint is shaped by what it does on the system, not what it was called in the development pitch. Reliability function determines obligation.
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> Behavior under stress is the gap between the data sheet and reality. Vendor specifications describe nominal performance. The standards expect performance during a disturbance.
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> Compliance for an IBR starts with understanding how the resource interacts with the grid. Programs that hand that understanding to the engineering team and wall it off from compliance create the wrong kind of separation.

2 NERC Registration: What Triggers It and What It Triggers

NERC registration is not optional for entities that meet the criteria, and it is not self-executing for those who do not know they meet them. Under the Rules of Procedure, NERC and the Regional Entities make their best efforts to identify every entity that meets the criteria, and when they find one that should be on the Compliance Registry and is not, they will add it. The process runs through the Regional Entity where the facility connects, and it takes affirmative engagement from the owner.

2.1 The Functional Registration Model

NERC assigns obligations by functional role, not by technology or ownership structure. For IBR owners and operators the relevant functions are Generator Owner and Generator Operator. They are distinct functions with distinct obligations, and the same entity or different entities may perform them depending on how the facility is owned and operated.

The Generator Owner owns and maintains the generating facilities. The Generator Operator operates them. For a plant operated by its owner, one entity performs both functions and registers for both. For a plant run by a third-party operator under a services agreement, the functions may be registered separately, with different entities holding different obligations. If a Category 2 GO has not yet settled who its GOP will be, WECC's registration guidance says the Regional Entity will advise it to register as both until that is resolved.

Getting the functional registration right matters because requirements attach to the registered function. An entity registered only as Generator Owner carries the GO obligations: equipment, models, ride-through design, protection system maintenance where it applies. An entity registered as Generator Operator carries the GOP obligations: real-time operations, coordination with the Balancing Authority and Transmission Operator, voltage schedules. Miss a functional registration and you miss the obligations that flow from it.

2.2 The Threshold Question

For BES generation, the thresholds come from the Bulk Electric System definition in the NERC Glossary. In 2024 the registry criteria changed. Appendix 5B to the NERC Rules of Procedure, Revision 8, effective June 27, 2024, now defines two categories of Generator Owner and Generator Operator. Category 1 covers the entity that owns and maintains, or operates, generating Facilities, which is the traditional BES population. Category 2 covers the entity that owns and maintains, or operates, non-BES inverter-based resources that either have or contribute to an aggregate nameplate capacity of 20 MVA or more, connected through a system designed primarily for delivering that capacity to a common point of connection at 60 kV or above. The same definitions now sit in the NERC Glossary.

That changes the old "may or may not" answer for a mid-sized plant. A 20 MVA solar facility delivering its output to a 69 kV point of connection is a Category 2 candidate. Aggregation counts too. WECC's registration guidance states that if multiple facilities aggregate to 20 MVA or more at a common point of connection at 60 kV or above, all of them are Category 2 assets and all of their owners and operators register.

What remains a judgment call is the facts: what the nameplate is, how the collector and interconnection facilities are configured, where the common point of connection actually sits. NERC published the ERO Enterprise CMEP Practice Guide: Application of the Registration Criteria for Category 2 Generator Owner and Generator Operator Inverter-Based Resources, in January 2025 for exactly these questions. Resolve them with the Regional Entity before commercial operation, not after.

2.3 What Happens If You Should Have Registered and Did Not

Many developers assume an unregistered facility is quietly accumulating penalties for every day it operates. That is not how the Rules of Procedure work, and the difference matters to how you plan.

Appendix 5B says NERC and the Regional Entities will not monitor or hold entities that are not on the Compliance Registry responsible for compliance. An entity identified later as material to the Bulk Power System is added to the registry, and it is not subject to a sanction or Penalty for actions or inactions before it was placed there. It may, however, be required to comply with a Remedial Action Directive or a Mitigation Plan to become compliant. From the day it is registered, it is responsible for compliance and can be penalized for future violations, including any failure to follow that directive or plan. Required compliance begins on the later of registration and regulatory approval of the applicable standards.

So the real exposure from a late registration is not back penalties. It is arriving on the registry with no program, no evidence, and the full set of obligations starting at once, sometimes under a Mitigation Plan with a schedule someone else set. That is a hard way to start.

2.4 Category 2: How the Registration Actually Ran

Registration was the third and final milestone of NERC's IBR Registration Initiative, which entered that phase in May 2025. Before that, NERC asked U.S. Balancing Authorities and Transmission Owners in mid-2024 to identify Category 2 candidates on their systems, and the ERO Enterprise began contacting candidates in the July 2024 to January 2025 window of its IBR work plan, with a further round in April and May 2025. Starting in August 2025, NERC sent formal notifications to verified candidates of their inclusion on the Compliance Registry with an effective date of May 15, 2026. WECC's guidance describes registrations processed in batches from August 2025 through April 2026.

The data request was more detailed than many owners expected. Category 2 candidates were asked to submit, through a secure portal such as the Centralized Organization Registration ERO System (CORES):

- a completed ERO Enterprise GO/GOP Asset Verification Form
- the Interconnection Agreement and any amendments

- operating or third-party agreements
- operating one-line diagrams from the generating resources through to the point of interconnection with the Transmission Owner or Distribution Provider
- nameplate data for the individual inverters or wind turbines

An owner who has concluded on its own that a facility does not meet the criteria still has to submit the requested documents. The Regional Entity makes the call after its review. Assembling that package takes coordination among the developer, the equipment vendors, the commissioning engineers, and the compliance team. It cannot be improvised the week a request arrives. It takes structured data collection that starts during design and is maintained through commissioning into operation.

2.5 The Registration Timeline Problem

Registration is not instantaneous. Submitting registration materials, completing the Regional Entity's review, and reaching an effective registration all take time, and the development and construction schedule rarely leaves room for it. For a project that will come online in phases, WECC's guidance is to start conversations and provide registration information as early as possible, even when the first phases meet only the Category 2 criteria and later phases will reach Category 1.

Start the registration process well before commercial operation, ideally alongside interconnection studies and permitting. The earlier it begins, the more time there is to resolve threshold questions, settle the functional registration, and have the compliance program for the ongoing obligations in place before the facility starts operating under them.

2.6 End-of-Chapter Summary

NERC registration has specific criteria, now including the Category 2 thresholds for non-BES IBRs. It runs on a functional model that assigns obligations by role rather than technology, and on a timeline that has to start well before commercial operation. Late registration does not create back penalties under Appendix 5B, but it does put the entity on the registry with every obligation starting at once and, possibly, a Mitigation Plan or Remedial Action Directive to work off. IBR developers who treat registration as a post-COD administrative task will consistently find themselves behind the compliance timeline.

> **From the Field**
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> Registration is a one-way door. Once you are registered, removal takes a Deactivation request to the Regional Entity with the basis and supporting documentation, and your compliance history is retained either way. Plan for the door, then walk through it deliberately.
>
> The Compliance Registry is posted on NERC's website. Your registration is visible to peer entities, regulators, market monitors, and counterparties. That visibility carries weight beyond the standards themselves.

3 Ongoing Compliance Obligations for Operating IBR Facilities

Registration is the beginning, not the end. The obligations that attach to a registered IBR Generator Owner and Generator Operator cover operational, technical, and administrative requirements that last for the life of the facility. Owners who see commercial operation as the end of the development process need to see it for what it is: the point where the obligations a registered plant carries start to bite.

3.1 Which Standards Apply, and When

Which standards apply depends on the category. A Category 1 GO or GOP with a BES inverter-based plant carries the full set of GO and GOP standards, subject to each standard's facility applicability. A Category 2 GO or GOP does not yet. NERC's compliance-dates document for GOs and GOPs (Q3 2026 update) lists eight existing standards that apply to Category 2 entities without modification, each with a Category 2 compliance date of May 15, 2026: BAL-001-TRE-2, IRO-010-5, MOD-032-2, PRC-012-2, PRC-017-1, TOP-003-6.1, VAR-001-5, and VAR-002-4.1. The new IBR standards written in response to FERC Order No. 901 name Category 2 facilities in their own applicability sections: PRC-028-1, PRC-029-2, PRC-030-1, and MOD-026-2. Most of the remaining GO and GOP standards, including EOP-004, PRC-005, PRC-024, and the CIP standards, are listed as requiring modification before they become applicable to Category 2 facilities.

Read your registration letter against that list, facility by facility. A portfolio with both BES plants and Category 2 plants will carry two different sets of obligations, and the program has to track both.

3.2 Dynamic Models: MOD-026-2

Model verification and validation for IBRs used to be an open standards question. It is now an enforceable standard. MOD-026-2, Verification and Validation of Dynamic Models and Data, became effective April 1, 2026, retiring MOD-026-1 and MOD-027-1. It applies to Generator Owners of BES inverter-based resources and of Category 2 inverter-based resources, among other facilities.

The concern behind it is that IBR dynamic models, the mathematical representations of how a plant responds to disturbances in planning studies, have often not matched what the plants actually did. A plant whose real behavior differs from its model gives planners assumptions that do not reflect the system. When those assumptions feed interconnection studies and operating decisions, the effect reaches well past the one facility.

Under MOD-026-2, the Generator Owner provides its Transmission Planner with positive sequence dynamic models, documentation of Model Verification and Model Validation, and, where the Transmission Planner requires them, electromagnetic transient (EMT) models. A newly commissioned facility transmits within 365 days after its commercial operation date. Models are re-verified and re-validated within ten years of the most recent transmittal. The requirement that matters most for an operating plant is Requirement R4: within 180 calendar days after a hardware, software, firmware, control mode, or setting change that alters the dynamic response, the Generator Owner must give the Transmission Planner updated models and documentation. The implementation plan phases this in. Requirements R2 through R6, including the R4 180-day update, do not apply until April 1, 2029, 36 months after the effective date.

The standard says it in black and white. A model is not a one-time submittal. It is maintenance, triggered by every change that touches dynamic response.

3.3 Ride-Through: PRC-029-2

Ride-through, the obligation for a plant to stay connected and keep operating through voltage and frequency disturbances, has long been part of the framework for conventional generation. For IBRs it now has its own standard. PRC-029-2, Frequency and Voltage Ride-through Requirements for Inverter-Based Resources, became effective October 1, 2026, replacing PRC-029-1. It applies to Generator Owners of BES IBRs and Category 2 IBRs. PRC-024-4, effective the same date, now covers synchronous generators, Type 1 and Type 2 wind, and synchronous condensers. IBRs moved to PRC-029.

PRC-029-2 requires the Generator Owner to ensure that the design and operation of each IBR meet the ride-through zones in the standard's attachments, with narrow exceptions such as disconnecting to clear a fault. It is a design obligation and a performance obligation, and the evidence reflects both: dynamic simulations, studies, plant protection settings and control settings for the design, plus disturbance recordings showing how the plant actually performed.

The implementation is phased. Design-based compliance for BES IBRs runs from the PRC-029-1 effective date. For applicable non-BES IBRs it begins on the later of January 1, 2027 or the PRC-029-1 effective date. The performance-based elements do not apply until the entity has the disturbance monitoring capability required by PRC-028-1's implementation plan. Requirement R4 provides a documented exemption process for IBRs with known hardware limitations that prevent them from meeting specific ride-through criteria, limited to facilities in service by the PRC-029-1 effective date or meeting the standard's long-lead procurement conditions, with submission deadlines set in the implementation plan.

What catches owners off guard is that ride-through is not a setting configured at commissioning and forgotten. Control settings change. Firmware updates change default behavior. Plant-level protection interacts with inverter-level settings in ways no one anticipated at commissioning. A plant that met its ride-through obligations on day one can fall short years later without anyone deciding to change anything.

That is the pattern the disturbance reports describe. The compliance obligation is to keep ride-through performance in place continuously, and to know when a change has put it at risk.

3.4 Protection System Maintenance: Know Where PRC-005 Stops

PRC-005 does not reach inverter control systems as broadly as many owners assume, and that matters for how you scope a maintenance program.

PRC-005-6 applies to Protection Systems, Automatic Reclosing, and Sudden Pressure Relaying that affect the BES. For dispersed power producing resources identified through Inclusion I4 of the BES definition, which is where a BES solar or wind plant falls, its facility scope is the Protection Systems and Sudden Pressure Relaying for facilities used in aggregating the dispersed generation, from the point where those resources aggregate to greater than 75 MVA to a common point of connection at 100 kV or above. In my reading, that usually means the collector aggregation, main power transformer, and interconnection protection, not the protective functions inside each inverter. PRC-005 is also on NERC's list of standards that require modification before they apply to Category 2 facilities.

Inverter-level protective functions do not escape scrutiny. They show up in other standards. PRC-029-2 expects plant protection and control settings to support ride-through, and the evidence of design includes them. MOD-026-2 requires the models to represent specified limiting and protective functions, including, for EMT models, the enabled protective functions that directly trip the IBR units or facility. PRC-030-1 requires analysis when the plant's output drops unexpectedly.

In my view, the bigger risk is not a missing PRC-005 interval. It is an owner who cannot produce the as-left inverter and plant controller settings, or cannot show that they match the model and the ride-through design. Maintain the PRC-005 program where PRC-005 applies, and keep a settings record for everything else.

3.5 Event Reporting and Event Analysis: EOP-004 and PRC-030-1

These two obligations get blurred together.

EOP-004-4, Event Reporting, applies to Category 1 Generator Owners and Generator Operators, among others. It requires an event reporting Operating Plan and requires reporting the events listed in its Attachment 1 by the later of 24 hours after recognizing that an event type threshold has been met or the end of the next business day. For a GO or GOP, the Attachment 1 event types are narrow: damage or destruction of its Facility from actual or suspected intentional human action, and physical threats to its Facility or suspicious devices or activity there. The generation loss and firm load events belong to the Reliability Coordinator, Balancing Authority, Transmission Operator, and Distribution Provider. An inverter trip that takes a 50 MW plant offline for 15 minutes is not, by itself, an EOP-004 report for the plant.

That changes in 2027 at the Balancing Authority level. EOP-004-5, effective October 1, 2027, adds an event type for IBR loss following a Disturbance. The Balancing Authority reports it, using telemetered IBR output, when the loss within 30 seconds after a Disturbance reaches 900 MW in the Eastern Interconnection, 500 MW in the Western and Quebec Interconnections, or 800 MW in the ERCOT Interconnection. If your Balancing Authority telemeters your plant, its output will be part of that calculation.

The obligation that does reach the individual plant is PRC-030-1, Unexpected Inverter-Based Resource Event Mitigation, effective October 1, 2026 for Generator Owners of BES IBRs, with Category 2 IBRs required to comply by January 1, 2027. The Generator Owner must have a documented process to identify any complete loss of facility output, or any change in Real Power of at least 20 MW and at least 10 percent of gross nameplate within a four-second period, excluding changes from resource variability, dispatch, ramping, planned outages and testing, and a few other listed causes. Within 90 calendar days of such an event, or of a request from its Reliability Coordinator, Balancing Authority, or Transmission Operator, the Generator Owner must analyze the plant's performance, determine root cause, document ride-through performance, and decide whether corrective action is needed. If it is, the Generator Owner has 60 days to develop a Corrective Action Plan or a technical justification and provide it to those entities, then implement the plan.

So the 15-minute inverter trip that looked like routine maintenance from the owner's side may well be a PRC-030-1 event. If the plant cannot detect it, it cannot analyze it, and the first request for the analysis may come from the Balancing Authority or the auditor, not from the plant.

3.6 End-of-Chapter Summary

The ongoing obligations for a registered IBR cover dynamic model maintenance under MOD-026-2, ride-through design and performance under PRC-029-2, protection system maintenance where PRC-005-6 applies, event detection and analysis under PRC-030-1, and event reporting under EOP-004 for the entities it reaches. Which of those apply, and when, depends on whether the plant is BES or Category 2. These obligations are not lighter than those for conventional generation. In several respects they are more complex, because the technology is less familiar to the framework and the standards addressing it are newer. Owners who bring the intensity they brought to development into post-COD compliance avoid the slow build-up of exposure that marks plants where compliance is an afterthought.

> **From the Field**
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> Registration starts the obligation. Commercial operation makes it real. From the day your registration and the applicable standards are both in effect, every standard that applies to the function applies to the facility, in real time, every day.
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> Operational, technical, and administrative requirements all attach. Programs that focus on the operational and shortchange the administrative get audited on the administrative gap.
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> The obligation lasts for the life of the facility. Asset sales, mergers, and repowers do not reset the clock. They transfer it.

4 The Evolving Standards: What Has Arrived and What Is Next

FERC Order No. 901, issued October 19, 2023, directed NERC to develop Reliability Standards addressing IBR performance, data sharing, model validation, and planning and operational studies, in a series of filings due November 4, 2024, November 4, 2025, and November 4, 2026. Several of the resulting standards are now in effect or phasing in.

4.1 Where the IBR Standards Stand

Standard	What it covers	Applies to	Status as of October 25, 2026
PRC-028-1	Disturbance monitoring and reporting for IBRs	GO, BES and Category 2 IBRs	Effective April 1, 2025, phased implementation
MOD-026-2	Verification and validation of dynamic models and data	GO, TO, TP and PC; facilities include BES and Category 2 IBRs	Effective April 1, 2026; GO R2, R3, R4, R6 from April 1, 2029
PRC-029-2	Frequency and voltage ride-through for IBRs	GO, BES and Category 2 IBRs	Effective October 1, 2026; replaced PRC-029-1
PRC-030-1	Unexpected IBR event mitigation	GO, BES and Category 2 IBRs	Effective October 1, 2026; Category 2 compliance January 1, 2027
PRC-024-4	Protection settings for synchronous and Type 1 and 2 wind resources	GO and TO; IBRs moved to PRC-029	Effective October 1, 2026
EOP-004-5	Event reporting, adds IBR loss following a Disturbance	BA reports the IBR loss event	Effective October 1, 2027

4.2 The Direction of the Performance Standards

NERC's disturbance investigations involving large amounts of IBR capacity keep identifying the same kinds of gap: insufficient ride-through margins, control interactions that cause protective tripping during grid disturbances, inaccurate dynamic models, and aggregation effects far larger than any single plant's characteristics would suggest. The standards that have arrived answer those findings directly. PRC-028-1 makes the plant record what happened. PRC-029-2 sets the ride-through obligation. PRC-030-1 makes the owner analyze and correct unexpected output loss. MOD-026-2 makes the model match the plant and stay matched.

For operating facilities, the important point is that new requirements reach plants built before they existed. There are limited accommodations. PRC-029-2 allows a documented hardware-

limitation exemption for qualifying in-service IBRs, and MOD-026-2 treats facilities with a commercial operation date before its effective date as legacy facilities for EMT model purposes. Those accommodations have conditions and deadlines, and they are not grandfathering.

4.3 Category 2: Registered Now, Applicability Still Expanding

Registration put Category 2 GOs and GOPs on the registry effective May 15, 2026, but most of the GO and GOP standards do not yet reach them. NERC's compliance-dates document states that, apart from the eight standards that apply without modification and those written for IBRs, each remaining GO and GOP standard will be assessed individually and taken through the standards development process. It also says that being on the list does not necessarily mean a standard will be revised for Category 2.

For a Category 2 owner, that means the list of applicable standards will grow, standard by standard, with notice and comment along the way. Track it quarterly. The document is updated with each quarterly IBR work plan filing NERC makes to FERC.

4.4 Interconnection-Wide Coordination: The Emerging Obligation

As IBR penetration grows, coordination between IBR operators and the Balancing Authorities, Transmission Operators, Transmission Planners, and Reliability Coordinators responsible for those systems is becoming more explicit. Some of that is now enforceable. PRC-030-1 requires the Generator Owner to analyze events at the request of its Reliability Coordinator, Balancing Authority, or Transmission Operator and to send them its Corrective Action Plans. PRC-029-2 lets the associated Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator direct whether a plant prioritizes real or reactive power during voltage disturbances. MOD-026-2 has the Transmission Planner and Planning Coordinator set the model requirements the Generator Owner must meet. NERC's May 2025 Level 3 Alert on IBR performance and modeling directed essential actions to Transmission Owners, Transmission Planners, Planning Coordinators, and Generator Owners to strengthen technical minimum requirements and study processes.

4.5 End-of-Chapter Summary

The IBR standards have moved from development to enforcement. Disturbance monitoring, ride-through, event mitigation, and model validation are now enforceable standards with phased compliance dates, and the Category 2 population is on the registry with applicability still expanding.

> **From the Field**
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> The IBR standards are no longer a forecast. PRC-028-1, MOD-026-2, PRC-029-2, and PRC-030-1 are in effect, and the Category 2 applicability list is still growing.
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> Every standards project traces back to a disturbance investigation, an operational issue, or a regulatory directive. Reading the projects tells you what the framework knows about IBR risk.
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> Programs that build for today's standards and not for the direction of travel rebuild after every revision. Direction matters more than snapshot.

5 Common Compliance Failures in IBR Programs

The failure patterns in IBR programs differ enough from those in conventional generation to deserve their own attention. They reflect the technology, the development community's compliance culture, and the gap between what NERC's framework requires and what IBR developers and operators have historically understood themselves to be responsible for.

5.1 The Post-COD Compliance Cliff

Development teams are motivated, well-resourced, and focused on the work that produces commercial operation: permitting, financing, construction, interconnection, and commissioning. The compliance work that follows COD, ongoing monitoring, reporting, model maintenance, and event analysis, is often under-resourced compared with the development work that came before it.

That creates what I call the post-COD compliance cliff: the move from an organization that is excellent at getting a project built to an operating organization that has to keep a plant compliant with a framework it does not fully understand. In my view, plants that handle the transition poorly end up with a stretch of non-compliance in the months after COD that surfaces years later through an audit or a self-assessment.

5.2 The Model Submission as a Checkbox

Dynamic model submissions are part of the Generator Owner's planning data obligations. In many IBR programs they are treated as a checkbox: submitted once from the vendor's standard template, then left alone until the next formal cycle no matter what has changed at the plant.

That produces models that drift further from reality as the plant ages, as firmware is updated, and as settings are modified. Under MOD-026-2 the obligation is not to submit a model once. It is to keep the model accurate, with updated models due within 180 days of a change that alters dynamic response, once R4 applies on April 1, 2029. When a post-disturbance analysis shows the plant behaved differently from its model, a missed update stops being a technical observation and becomes a compliance finding.

5.3 Treating the PPA as the Compliance Boundary

Developers who sell output under power purchase agreements sometimes act as though their compliance obligations end where the PPA ends, as though the counterparty's obligations define the developer's regulatory exposure. That is wrong, and it is consequential.

NERC obligations attach to registered entities, not to contract parties. A registered Generator Owner is responsible for its own compliance whatever the PPA says about operations. A

registered Generator Operator is responsible for its own operational performance whatever dispatch instructions it receives under contract. Contracts can allocate cost and responsibility between parties. They cannot move the regulatory obligation off the registered entity. The one mechanism that does shift registration responsibility is a written agreement transferring compliance responsibility to another entity that registers for the transferred function, under Appendix 5B and Sections 501, 507, and 508 of the Rules of Procedure. A PPA is not that agreement.

5.4 End-of-Chapter Summary

IBR compliance failures cluster around the post-COD transition, model maintenance, and a basic misunderstanding of where obligations begin and end. The development community that builds these projects is sophisticated, experienced, and capable. The compliance culture that governs their operating obligations is still maturing. Owners who bridge that gap, applying development-phase discipline to post-COD compliance, build operating programs that carry the obligations their plants hold.

> **From the Field**
>
> IBR compliance failures are not conventional generation failures with a different label. The technology is different, the development culture is different, and the gap between what the framework expects and what the project assumed is wider.
>
> A common IBR compliance failure: assuming the protection and control settings the OEM provided meet the standards. Sometimes they do not. The owner is accountable for verifying.
>
> Compliance culture in IBR development teams varies widely. Some treat NERC obligations as engineering inputs. Others treat them as procurement items to pass to the EPC. Both approaches produce findings.

6 Building a Compliance Program That Scales With Your Portfolio

For developers and operators with many IBR facilities at different stages of development, construction, and operation, compliance is not a facility problem. It is a portfolio program management problem. What works for one plant does not scale to ten or twenty, and the failures that build up across a portfolio can produce enforcement exposure that threatens the business.

6.1 Standardize Registration and Commissioning Checklists

The most effective tool a portfolio operator has is a standard registration and commissioning checklist, built from the requirements and applied to every facility regardless of size or market. It should cover the registration criteria assessment (BES, Category 2, or neither), the functional registration decisions, the registration data package, protection system commissioning documentation, the as-left inverter and plant controller settings, the ride-through design evidence, disturbance monitoring capability, dynamic model preparation and submission, and the handoff from the development team to the operating team.

Standardization does not mean every plant has the same requirements. Market rules, interconnection agreement terms, and facility characteristics differ, and BES and Category 2 plants carry different standards. It means the process for deciding what applies to each plant, and for making sure it is met at each stage of the plant's life, is consistent and documented.

6.2 The Compliance Handoff Is a Risk Event

Every IBR facility goes through a compliance handoff, the point where development-phase compliance work ends and operating-phase obligations begin. It is a risk event because information, context, and institutional knowledge about the plant's compliance status move between teams. Whatever gets lost or garbled in the handoff becomes a gap that may not surface until an audit finds it years later.

A structured handoff should include a complete inventory of registration submissions and their status; the protection system commissioning records and how they tie to ongoing maintenance; the as-left settings and the models submitted under MOD-026-2; a schedule of every recurring reporting, model, and data obligation with its deadline; and a named owner for each obligation going forward. Document the handoff, and have the receiving team confirm in writing that it understands what it is taking on.

6.3 Monitoring Standards Development Is an Operational Obligation

For an IBR portfolio operator, tracking NERC standards development is not a nice-to-have. It is an operational obligation. Standards in development today carry compliance dates that will

reach operating plants later. Plants built and operated without awareness of where the standards are heading face retrofit obligations that cost more and disrupt more than the design accommodations that could have been made earlier.

Assign someone in the compliance organization to track NERC standards development, take part in the comment process on standards that affect IBR facilities, and assess what proposed requirements mean for the existing portfolio. For a Category 2 portfolio, include the quarterly compliance-dates update in that job. The IBR standards agenda is active and consequential. Operators who are not engaged with it are making compliance decisions in the dark.

6.4 End-of-Chapter Summary

Portfolio-level IBR compliance takes standardized processes, structured handoffs, and active engagement with standards development. Plants that are developed, commissioned, and operated through disciplined compliance processes are positioned to find and fix gaps before an auditor does. In my view, at portfolio scale, the difference between a reactive and a proactive compliance culture shows up in the findings across the operating fleet.

Glossary of Terms

Term	Meaning in this paper
Balancing Authority (BA)	The responsible entity that integrates resource plans ahead of time, maintains Demand and resource balance within a Balancing Authority Area, and supports Interconnection frequency in real time (NERC Glossary). IBR Generator Operators coordinate with their BA for dispatch, real-time operations, and disturbance response.
Category 2 Generator Owner and Generator Operator	The entity that owns and maintains (GO), or operates (GOP), non-BES Inverter-Based Resources that either have or contribute to an aggregate nameplate capacity of 20 MVA or more, connected through a system designed primarily for delivering that capacity to a common point of connection at 60 kV or above (NERC Glossary; ROP Appendix 5B). Category 2 entities were registered effective May 15, 2026.
Commercial Operation Date (COD)	The date a generating facility begins commercial operation. COD does not by itself trigger NERC obligations. Required compliance begins on the later of registration and regulatory approval of the applicable standards, and several standards set deadlines measured from COD, such as MOD-026-2's 365-day initial model transmittal.
Compliance Registry	NERC's list of the owners, operators, and users of the Bulk Power System that are subject to approved Reliability Standards, organized by registered function. It is available on NERC's website.
Dynamic Model	A mathematical representation of a generating facility's electrical and control behavior, used in planning studies. Under MOD-026-2, IBR models must represent the in-service equipment and be updated after changes that alter dynamic response.
Generator Operator (GOP)	The entity that operates generating Facilities and performs the functions of supplying energy and Interconnected Operations Services (Category 1 GOP), or that operates Category 2 IBRs (Category 2 GOP) (NERC Glossary).
Generator Owner (GO)	The entity that owns and maintains generating Facilities (Category 1 GO), or that owns and maintains Category 2 IBRs (Category 2 GO) (NERC Glossary).
Inverter-Based Resource (IBR)	A plant or facility consisting of individual devices that are capable of exporting Real Power through a power electronic interface such as an inverter or converter, and that are operated together as a single resource at a common point of interconnection. Examples include solar PV, Type 3 and Type 4 wind, battery energy storage, and fuel cell facilities (NERC Glossary).
Model Validation	The process of comparing simulation results with measurements to assess how closely a model's behavior matches the measured behavior (NERC Glossary).

Term	Meaning in this paper
Model Verification	The process of confirming that model structure and parameter values are representative of the equipment or facility design and settings by reviewing design and settings documentation (NERC Glossary).
Protection System	Protective relays that respond to electrical quantities; communications systems necessary for correct operation of protective functions; voltage and current sensing devices providing inputs to protective relays; station dc supply associated with protective functions; and control circuitry associated with protective functions through the trip coils of the circuit breakers or other interrupting devices (NERC Glossary). PRC-005-6 sets which Protection Systems at a dispersed generating plant are within its maintenance scope.
Ride-through	The plant or facility remains connected and continues to operate through voltage or frequency system disturbances (NERC Glossary). PRC-029-2 sets the ride-through requirements for IBRs.
Transmission Operator (TOP)	The entity responsible for the reliability of its local transmission system, and that operates or directs the operations of the transmission Facilities (NERC Glossary). IBR Generator Operators coordinate with their TOP on interconnection operations, curtailment, and disturbance response.
Transmission Planner (TP)	The entity that develops a long-term plan for the reliability of the interconnected bulk electric transmission systems within its portion of the Planning Authority area (NERC Glossary). Under MOD-026-2, the Generator Owner submits its models to the TP.
Utility-Scale Solar	A working term, not a NERC defined term: solar generation connected at transmission or subtransmission voltage through a dedicated step-up transformer. Whether a given plant is registered depends on the BES definition and the Category 2 criteria, not on this label.

How Energy Compliance Can Help

An auditor will eventually ask three things about an IBR fleet: whether you are registered for the right functions, whether each plant's settings, models, and event analyses match the standards that apply to it, and whether your program can keep up as the Category 2 list grows. Three services fit those questions:

- **Registration and applicability analysis.** Whether each plant is BES, Category 2, or neither, which functions to register, and which standards apply on which dates.
- **Compliance program design and management.** The standardized checklists and handoff process described in Chapter 6, built for your portfolio.
- **Audit defense.** Audit preparation, RSAW production, and data request strategy for the IBR standards, with Notice of Penalty response and settlement posture if it comes to that.

The IBR compliance services listed in the earlier edition of this reference remain available: registration trigger assessment and functional registration support; compliance program design for new IBR facilities; dynamic model validation support and submission preparation; ride-through and protection system compliance assessment; portfolio-level compliance program development; and disturbance reporting support and root cause analysis. So do the firm's broader services: NERC reliability and compliance advisory support; reliability governance and program assessments; registration and applicability analysis; operational and engineering reliability alignment; compliance program design and improvement; audit and enforcement support (non-advocacy); mitigation planning and Self-Report development; training and executive briefings on reliability frameworks; regulator-perspective program reviews; senior advisory on complex reliability and registration questions; and industry engagement through standards development and working-group participation.

WattOps Compliance

WattOps Compliance is EC's NERC compliance evidence platform (wattopscompliance.com). It is where the MOD-026-2, PRC-029-2, and PRC-030-1 evidence lives. EC will run one standard at one facility through WattOps at no cost (CIP standards excluded).

RenewOps

RenewOps is EC's renewable operations monitoring and analytics platform, with a Data Center module. It puts the operations data behind event detection and ride-through analysis in front of the people who have to explain what the plant did.

If your ride-through evidence is still a vendor data sheet, call.

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About the Author

Rob Smith is the Founder and Principal of Energy Compliance, Inc., with more than thirty years in the industry on every side of the system. He began in control-room operations as a Reliability Coordinator, Transmission Operator, and Power System Operator across RTO/ISO and utility control centers. On the regulator side, he was a senior compliance auditor and subject matter expert for NERC Reliability Standards. He audited grid facilities, evaluated mitigation adequacy, participated in risk-based oversight of utility mitigation activities, and supported the development of violation notifications and settlements in FERC-directed enforcement actions. He conducted a regulatory audit in the Sultanate of Oman against the Sultanate's Sector Law and Grid Code.

He founded Energy Compliance, Inc. to deliver senior regulator-side compliance authority without the layered staffing and billable-hour overhead of larger firms.

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About Energy Compliance, Inc.

Energy Compliance, Inc. is an independent consulting and advisory firm based in Bloomington, Minnesota, focused exclusively on electric reliability, cybersecurity reliability, and regulatory compliance for organizations connected to the North American Bulk Electric System.

We support registered entities, including Generator Owners and Operators, Transmission Owners and Operators, Reliability Coordinators, Balancing Authorities, and Distribution Providers. Our work spans NERC Reliability Standards, FERC orders, RTO/ISO market participation rules, Regional Entity oversight, and state regulatory frameworks.

We do this work differently than larger consulting firms. A senior practitioner with regulator-side experience oversees every engagement. We staff for outcomes, not billable hours. Our deliverables are written to be operationally executable and audit-defensible, structured for the auditor's question rather than the consultant's binder. Where automation can replace manual work, we build the automation. Where senior judgment is required, the senior is in the room.

Energy Compliance operates with complete independence from regulatory and oversight bodies, and is not affiliated with, sponsored by, or endorsed by the North American Electric Reliability Corporation, the Federal Energy Regulatory Commission, or any Regional Entity.

Learn more at energycomplianceinc.com.

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