

## Comment Report

**Project Name:** 2020-02 Modifications to PRC-024 (Generator Ride-through) | PRC-029-1  
**Comment Period Start Date:** 7/22/2024  
**Comment Period End Date:** 8/12/2024  
**Associated Ballots:** 2020-02 Modifications to PRC-024 (Generator Ride-through) Implementation Plan AB 3 OT  
2020-02 Modifications to PRC-024 (Generator Ride-through) PRC-029-1 AB 3 ST

There were 70 sets of responses, including comments from approximately 159 different people from approximately 112 companies representing 10 of the Industry Segments as shown in the table on the following pages.

## **Questions**

- 1. Do you agree with the proposed definition of Ride-through? If not, please state what revision would be acceptable and why.**
- 2. Do you agree with the changes made in this draft of PRC-029-1?**
- 3. Provide any additional comments for the Drafting Team to consider, if desired.**

Organization Name	Name	Segment(s)	Region	Group Name	Group Member Name	Group Member Organization	Group Member Segment(s)	Group Member Region
MRO	Anna Martinson	1,2,3,4,5,6	MRO	MRO Group	Shonda McCain	Omaha Public Power District (OPPD)	1,3,5,6	MRO
					Michael Brytowski	Great River Energy	1,3,5,6	MRO
					Jamison Cawley	Nebraska Public Power District	1,3,5	MRO
					Jay Sethi	Manitoba Hydro (MH)	1,3,5,6	MRO
					Husam Al-Hadidi	Manitoba Hydro (System Performance)	1,3,5,6	MRO
					Kimberly Bentley	Western Area Power Administration	1,6	MRO
					Jaimin Patal	Saskatchewan Power Corporation (SPC)	1	MRO
					George Brown	Pattern Operators LP	5	MRO
					Larry Heckert	Alliant Energy (ALTE)	4	MRO
					Terry Harbour	MidAmerican Energy Company (MEC)	1,3	MRO
					Dane Rogers	Oklahoma Gas and Electric (OG&E)	1,3,5,6	MRO
					Seth Shoemaker	Muscatine Power & Water	1,3,5,6	MRO
					Michael Ayotte	ITC Holdings	1	MRO
					Andrew Coffelt	Board of Public Utilities-Kansas (BPU)	1,3,5,6	MRO
					Peter Brown	Invenergy	5,6	MRO
Angela Wheat	Southwestern Power Administration	1	MRO					

MRO	Anna Martinson	1,2,3,4,5,6	MRO	MRO Group	Bobbi Welch	Midcontinent ISO, Inc.	2	MRO
Southwest Power Pool, Inc. (RTO)	Charles Yeung	2	MRO,NPCC,RF,SERC,SPPRE,Texas RE,WECC	SRC 2024	Charles Yeung	SPP	2	MRO
					Ali Miremadi	CAISO	1	WECC
					Bobbi Welch	Midcontinent ISO, Inc.	2	MRO
					Greg Campoli	NYISO	1	NPCC
					Elizabeth Davis	PJM	2	RF
					Matt Goldberg	ISO New England	2	NPCC
WEC Energy Group, Inc.	Christine Kane	3		WEC Energy Group	Christine Kane	WEC Energy Group	3	RF
					Matthew Beilfuss	WEC Energy Group, Inc.	4	RF
					Clarice Zellmer	WEC Energy Group, Inc.	5	RF
					David Boeshaar	WEC Energy Group, Inc.	6	RF
ACES Power Marketing	Jodirah Green	1,3,4,5,6	MRO,NPCC,RF,SERC,Texas RE,WECC	ACES Collaborators	Bob Soloman	Hoosier Energy Electric Cooperative	1	RF
					Kris Carper	Arizona Electric Power Cooperative, Inc.	1	WECC
					Jason Proconiar	Buckeye Power, Inc.	4	RF
					Jolly Hayden	East Texas Electric Cooperative, Inc.	NA - Not Applicable	Texas RE
					Scott Brame	North Carolina Electric Membership Corporation	3,4,5	SERC
					Nick Fogleman	Prairie Power, Inc.	1,3	SERC
FirstEnergy - FirstEnergy Corporation	Mark Garza	4		FE Voter	Julie Severino	FirstEnergy - FirstEnergy Corporation	1	RF
					Aaron Ghodooshim	FirstEnergy - FirstEnergy Corporation	3	RF

FirstEnergy - FirstEnergy Corporation	Mark Garza	4		FE Voter	Robert Loy	FirstEnergy - FirstEnergy Solutions	5	RF
					Mark Garza	FirstEnergy-FirstEnergy	1,3,4,5,6	RF
					Stacey Sheehan	FirstEnergy - FirstEnergy Corporation	6	RF
Southern Company - Southern Company Services, Inc.	Pamela Hunter	1,3,5,6	SERC	Southern Company	Matt Carden	Southern Company - Southern Company Services, Inc.	1	SERC
					Joel Dembowski	Southern Company - Alabama Power Company	3	SERC
					Ron Carlsen	Southern Company - Southern Company Generation	6	SERC
					Leslie Burke	Southern Company - Southern Company Generation	5	SERC
Black Hills Corporation	Rachel Schuldt	6		Black Hills Corporation - All Segments	Micah Runner	Black Hills Corporation	1	WECC
					Josh Combs	Black Hills Corporation	3	WECC
					Rachel Schuldt	Black Hills Corporation	6	WECC
					Carly Miller	Black Hills Corporation	5	WECC
					Sheila Suurmeier	Black Hills Corporation	5	WECC
Northeast Power Coordinating Council	Ruida Shu	1,2,3,4,5,6,7,8,9,10	NPCC	NPCC RSC	Gerry Dunbar	Northeast Power Coordinating Council	10	NPCC
					Deidre Altobell	Con Edison	1	NPCC
					Michele Tondalo	United Illuminating Co.	1	NPCC
					Stephanie Ullah-Mazzuca	Orange and Rockland	1	NPCC

Northeast Power Coordinating Council	Ruida Shu	1,2,3,4,5,6,7,8,9,10	NPCC	NPCC RSC	Michael Ridolfino	Central Hudson Gas & Electric Corp.	1	NPCC
					Randy Buswell	Vermont Electric Power Company	1	NPCC
					James Grant	NYISO	2	NPCC
					Dermot Smyth	Con Ed - Consolidated Edison Co. of New York	1	NPCC
					David Burke	Orange and Rockland	3	NPCC
					Peter Yost	Con Ed - Consolidated Edison Co. of New York	3	NPCC
					Salvatore Spagnolo	New York Power Authority	1	NPCC
					Sean Bodkin	Dominion - Dominion Resources, Inc.	6	NPCC
					David Kwan	Ontario Power Generation	4	NPCC
					Silvia Mitchell	NextEra Energy - Florida Power and Light Co.	1	NPCC
					Sean Cavote	PSEG	4	NPCC
					Jason Chandler	Con Edison	5	NPCC
					Tracy MacNicoll	Utility Services	5	NPCC
					Shivaz Chopra	New York Power Authority	6	NPCC
					Vijay Puran	New York State Department of Public Service	6	NPCC
					David Kiguel	Independent	7	NPCC
					Joel Charlebois	AESI	7	NPCC
Joshua London	Eversource Energy	1	NPCC					
Jeffrey Streifling	NB Power Corporation	1,4,10	NPCC					

Northeast Power Coordinating Council	Ruida Shu	1,2,3,4,5,6,7,8,9,10	NPCC	NPCC RSC	Joel Charlebois	AESI	7	NPCC
					John Hastings	National Grid	1	NPCC
					Erin Wilson	NB Power	1	NPCC
					James Grant	NYISO	2	NPCC
					Michael Couchesne	ISO-NE	2	NPCC
					Kurtis Chong	IESO	2	NPCC
					Michele Pagano	Con Edison	4	NPCC
					Bendong Sun	Bruce Power	4	NPCC
					Carvers Powers	Utility Services	5	NPCC
					Wes Yeomans	NYSRC	7	NPCC
Dominion - Dominion Resources, Inc.	Sean Bodkin	6		Dominion	Victoria Crider	Dominion Energy	3	NA - Not Applicable
					Sean Bodkin	Dominion Energy	6	NA - Not Applicable
					Steven Belle	Dominion Energy	1	NA - Not Applicable
					Barbara Marion	Dominion Energy	5	NA - Not Applicable
Western Electricity Coordinating Council	Steven Rueckert	10		WECC	Steve Rueckert	WECC	10	WECC
					Curtis Crews	WECC	10	WECC
Tim Kelley	Tim Kelley		WECC	SMUD and BANC	Nicole Looney	Sacramento Municipal Utility District	3	WECC
					Charles Norton	Sacramento Municipal Utility District	6	WECC
					Wei Shao	Sacramento Municipal Utility District	1	WECC
					Foung Mua	Sacramento Municipal Utility District	4	WECC
					Nicole Goi	Sacramento Municipal Utility District	5	WECC
					Kevin Smith	Balancing Authority of Northern California	1	WECC

1. Do you agree with the proposed definition of Ride-through? If not, please state what revision would be acceptable and why.

**Rachel Schuldt - Black Hills Corporation - 6, Group Name** Black Hills Corporation - All Segments

**Answer** No

**Document Name**

**Comment**

Black Hills Corporation supports the comments provided by the NAGF which state: a. Recommend removing the word “entire” and the phrase “in its entirety” from the proposed definition; b. adding the following revised language “...and continuing to operate through System Disturbances as defined in the applicable Reliability Standards.”

Likes 0

Dislikes 0

**Response**

**Andy Thomas - Duke Energy - 1,3,5,6 - SERC,RF**

**Answer** No

**Document Name**

**Comment**

Duke Energy agrees with and supports the following NAGF comment:

The NAGF does not agree with the proposed definition of Ride-through and provides the following recommendations for consideration:

- a. Recommend removing the word “entire” and the phrase “in its entirety” from the proposed definition.
- b. Recommend adding the following revised language “...and continuing to operate through System Disturbances as defined in the applicable Reliability Standards.”

Likes 0

Dislikes 0

**Response**

**Robert Follini - Avista - Avista Corporation - 3**

**Answer** No

**Document Name**

**Comment**

See EEi comments



Likes 0

Dislikes 0

**Response**

**Brian Van Gheem - Radian Generation - NA - Not Applicable - NA - Not Applicable**

**Answer**

No

**Document Name**

**Comment**

1. We believe the addition of “in its entirety” is ambiguous and misplaced within the proposed definition. We propose the phrase should be moved to the end to imply the entire time duration of a Disturbance, from the start of the Disturbance to its return to pre-disturbance conditions.
2. We believe the addition of the term “System” should be removed from the definition. According to the NERC Glossary of Terms, the term is defined as “a combination of generation, transmission, and distribution components.” This proposed Reliability Standard only applies to Generator Owners, an entity that would not possess transmission and distribution asset components.
3. We believe the reference to the term “Disturbance” within the definition is too vague by itself. The proposed title of this Reliability Standard is “Frequency and Voltage Ride-through Requirements for Inverter-Based Resources.” The proposed purpose of this Reliability Standard is “to ensure that [Inverter-Based Resources] IBRs Ride-through to support the Bulk Power System (BPS) during and after defined frequency and voltage excursions.” Both imply any definition used in reference to this Reliability Standard should be narrowed to unplanned Frequency and Voltage events that produce abnormal system conditions or deviations to the electric system, as derived from term’s definition listed within the NERC Glossary of Terms. Therefore, we propose ending the “Ride-through” definition with the phrase “through the duration of a frequency or voltage Disturbance in its entirety, from its start to the return to pre-disturbance conditions.”

Likes 0

Dislikes 0

**Response**

**Wayne Sipperly - North American Generator Forum - 5 - MRO,WECC,Texas RE,NPCC,SERC,RF**

**Answer**

No

**Document Name**

**Comment**

*The NAGF does not agree with the proposed definition of Ride-through and provides the following recommendations for consideration:*

- a. *Recommend removing the word “entire” and the phrase “in its entirety” from the proposed definition.*
- b. *Recommend adding the following revised language “...and continuing to operate through System Disturbances as defined in the applicable Reliability Standards.”*

Likes 0

Dislikes 0

**Response**

**Alison MacKellar - Constellation - 5**

**Answer** No

**Document Name**

**Comment**

Constellation aligns with NAGF comments. Legacy inverters will not be able to ride through voltage and frequency events. It's important to include exemption for legacy inverters.

Alison Mackellar on behalf of Constellation Segments 5 and 6

Likes 0

Dislikes 0

**Response**

**Megan Melham - Decatur Energy Center LLC - 5**

**Answer** No

**Document Name**

**Comment**

Capital Power supports the NAGF's comments:

*The NAGF does not agree with the proposed definition of Ride-through and provides the following recommendations for consideration:*

*a. Recommend removing the word "entire" and the phrase "in its entirety" from the proposed definition.*

*b. Recommend adding the following revised language "...and continuing to operate through System Disturbances as defined in the applicable Reliability Standards."*

Likes 0

Dislikes 0

**Response**

**Richard Vendetti - NextEra Energy - 5**

**Answer** No

**Document Name**

**Comment**

NextEra believes that the definition of ride-through is too broad and does not directly tie back to voltage or frequency requirements. The word "entire" leaves too much room for interpretation of single IBR unit driving an unnecessary investigation.

Likes 0

Dislikes 0

**Response**

**Kimberly Turco - Constellation - 6**

**Answer** No

**Document Name**

**Comment**

Constellation aligns with NAGF comments. Legacy inverters will not be able to ride through voltage and frequency events. It's important to include exemption for legacy inverters.

Kimberly Turco on behalf of Constellation Energy Segments 5 and 6.

Likes 0

Dislikes 0

**Response**

**Hillary Creurer - Allete - Minnesota Power, Inc. - 1**

**Answer** No

**Document Name**

**Comment**

Minnesota Power (hereafter MP) agrees with EEI that the "ride-through" definition was clearer as proposed in IEEE 2800-2022.

Likes 0

Dislikes 0

**Response**

**Devin Shines - PPL - Louisville Gas and Electric Co. - 1,3,5,6 - SERC,RF**

**Answer** No

**Document Name**

**Comment**

LG&E/KU agrees with EEI; there is no reason to deviate from the definition included in IEEE Std 2800-2022 and IEEE Std 1547-2018: "Ability to withstand voltage or frequency disturbances inside defined limits and to continue operating as specified." This definition makes it more clear that there are "limits" to Ride-through. The definition proposed by the DT implies that *any* tripping is failed Ride-through, even if the trip occurs for a condition where it is acceptable. Include the IEEE definition verbatim, there is no need for modification.

Likes 0

Dislikes 0

### Response

**Selene Willis - Edison International - Southern California Edison Company - 5**

Answer

No

Document Name

Comment

"Please see EEI Comments"

Likes 0

Dislikes 0

### Response

**Christine Kane - WEC Energy Group, Inc. - 3, Group Name WEC Energy Group**

Answer

No

Document Name

Comment

WEC Energy Group supports the comments of the NAGF for Question 1.

Likes 0

Dislikes 0

### Response

**Carver Powers - Utility Services, Inc. - 4**

Answer

No

Document Name

Comment

Request clarification on the meaning of “in its entirety” and its intended purpose. Its inclusion adds confusion as the beginning of the definition already states “the entire plant/facility”. Does “in its entirety” apply to the entire facility, or the entire disturbance event?

Recommend “Ride-through: The entire plant/facility remaining connected to the Bulk Power System and continuing to operate through System Disturbances.”

Likes 0

Dislikes 0

### Response

**Steven Taddeucci - NiSource - Northern Indiana Public Service Co. - 3**

**Answer**

No

**Document Name**

**Comment**

NIPSCO believes that the definition of ride-through is too broad and does not directly tie back to voltage or frequency requirements. The word “entire” leaves too much room for interpretation of single IBR unit driving an unnecessary investigation.

Likes 0

Dislikes 0

### Response

**Jens Boemer - Electric Power Research Institute - NA - Not Applicable - NA - Not Applicable**

**Answer**

No

**Document Name**

**Comment**

B. Ride-through definition

· Consider adopting definition from IEEE 2800, which is from IEEE 1547, and well understood by the industry.

Likes 0

Dislikes 0

### Response

**Colin Chilcoat - Invenergy LLC - 6**

**Answer**

No

**Document Name**

**Comment**

Invenergy recommends removing “entire” and “in its entirety” from the proposed definition. As written, the definition attempts to prescribe an unreasonable interpretation of what ride-through should be from a system reliability perspective.

Likes 0

Dislikes 0

**Response****Rhonda Jones - Invenergy LLC - 5**

**Answer**

No

**Document Name**

**Comment**

Invenergy recommends removing “entire” and “in its entirety” from the proposed definition. As written, the definition attempts to prescribe an unreasonable interpretation of what ride-through should be from a system reliability perspective.

Likes 0

Dislikes 0

**Response****George E Brown - Pattern Operators LP - 5**

**Answer**

No

**Document Name**

**Comment**

Pattern Energy does not believe it is necessary to add a glossary term for Ride-Through. Ride-through is an operational requirement that is defined by a set of magnitudes and should remain defined within the requirements of the NERC Reliability Standards, as traditionally done.

Likes 0

Dislikes 0

**Response****Srinivas Kappagantula - Arevon Energy - 5**

**Answer**

No

**Document Name**

**Comment**

Please refer to NAGF comments.

Likes 0

Dislikes 0

### Response

#### Bobbi Welch - Midcontinent ISO, Inc. - 2

Answer

No

Document Name

### Comment

MISO supports the comments of the ISO/RTO Council (IRC) Standards Review Committee (SRC).

In addition, we believe it is important to get the wording of the Ride-through definition accurate and clear. If the language is not clear (as to what is allowed/disallowed), it will likely lead to future disagreements.

One possible solution is to add the words "as specified" to the **Ride-through** definition to more explicitly tie the definition to the requirements under the proposed PRC-029 standard as shown below.

**Ride-through:** The entire plant/facility remaining connected to the Bulk Power System, and continuing in its entirety to operate as specified through the time frame of System Disturbances.

This is only one possible approach to better capture the intent of the standard as described in the below excerpt from the **PRC-029-1 Technical Rationale, Rational for Requirement R3** (page 6) which references the need to remain synchronized, an important aspect to specify:

"The objective of Requirement R3 is to ensure that IBRs remain electrically connected, *synchronized*, and exchanging current, that is, continuing to operate during a frequency excursion event."

Likes 0

Dislikes 0

### Response

#### Jennifer Neville - Western Area Power Administration - 1,6

Answer

No

Document Name

### Comment

Support MRO NSRF comments

Likes 0

Dislikes 0

### Response

**Kennedy Meier - Electric Reliability Council of Texas, Inc. - 2**

**Answer** No

**Document Name**

**Comment**

ERCOT joins the comments submitted by the ISO/RTO Council (IRC) Standards Review Committee (SRC) and adopts them as its own. In addition, ERCOT notes that revising the definition of the term "Ride-through" to recognize that the continued operation associated with ride-through needs to be maintained not just through the Disturbance but all the way through recovery to a new operating point would result in a clearer definition that better aligns with PRC-030, which provides that IBR unit losses (partial trips) are not allowed.

ERCOT supports the alternative definition of Ride-through that the SRC proposed, and ERCOT would also support revising that definition to read as follows: "Ride-through: The entire plant/facility (**including its dispersed power producing inverters**) remaining connected to the electric system and continuing in its entirety to operate in a manner that supports grid reliability through a System Disturbance, including the period of recovery back to a normal operating condition."

Likes 0

Dislikes 0

**Response**

**Kyle Thomas - Elevate Energy Consulting - NA - Not Applicable - NA - Not Applicable**

**Answer** No

**Document Name**

**Comment**

The definition of ride-through should be updated as follows: "The entire plant/facility remaining connected to the Bulk Power System and continuing in its entirety to operate **as specified** through System Disturbances **inside defined limits**."

Likes 0

Dislikes 0

**Response**

**Brian Lindsey - Entergy - 1**

**Answer** Yes

**Document Name**

**Comment**

No Comment



Likes 0

Dislikes 0

**Response**

**Mark Garza - FirstEnergy - FirstEnergy Corporation - 4, Group Name FE Voter**

**Answer** Yes

**Document Name**

**Comment**

FirstEnergy has no objections to the proposed definition of Ride-through definition.

Likes 0

Dislikes 0

**Response**

**Marcus Bortman - APS - Arizona Public Service Co. - 6**

**Answer** Yes

**Document Name**

**Comment**

None

Likes 0

Dislikes 0

**Response**

**Patricia Lynch - NRG - NRG Energy, Inc. - 5**

**Answer** Yes

**Document Name**

**Comment**

NRG Energy Inc is in support of the comments made by EPSA.

Likes 0

Dislikes 0

**Response**

**Stephanie Kenny - Edison International - Southern California Edison Company - 6**

**Answer** Yes

**Document Name**

**Comment**

See EEI Comments

Likes 0

Dislikes 0

**Response**

**Kristine Martz - Edison Electric Institute - NA - Not Applicable - NA - Not Applicable**

**Answer** Yes

**Document Name**

**Comment**

EEI does not oppose the proposed definition of Ride-through.

Likes 0

Dislikes 0

**Response**

**Nick Leathers - Ameren - Ameren Services - 3 - SERC**

**Answer** Yes

**Document Name**

**Comment**

Ameren does not have any additional comments for consideration by the drafting team.

Likes 0

Dislikes 0

**Response**

**Pamela Hunter - Southern Company - Southern Company Services, Inc. - 1,3,5,6 - SERC, Group Name Southern Company**

**Answer** Yes

**Document Name**

**Comment**

Southern Company suggests using a different word or phrase for ...“entire” plant/facility... to indicate that the expectation is that no equipment should drop out of service during the disturbance and remain connected throughout the disturbance. The use of the word “entire” could mean all plant equipment, including that which is already out of service for other reasons.

Suggested wording:

“The plant/facility shall remain connected and in service, maintaining the pre-disturbance equipment configuration in operation, throughout the entirety of the system disturbance and recovery.”

Likes 0

Dislikes 0

### Response

**Steven Rueckert - Western Electricity Coordinating Council - 10, Group Name WECC**

**Answer**

Yes

**Document Name**

**Comment**

While WECC voted Affirmative, WECC suggests the DT emphasize the nature of the definition may not allow a single turbine or solar array to be lost in a System Disturbance (equates to failed “Ride-through” with loss).

Likes 0

Dislikes 0

### Response

**Ayslynn Mcavoy - Arkansas Electric Cooperative Corporation - 3**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

### Response

**Rachel Coyne - Texas Reliability Entity, Inc. - 10**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Thomas Foltz - AEP - 5**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Bruce Walkup - Arkansas Electric Cooperative Corporation - 6**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Jennifer Weber - Tennessee Valley Authority - 1,3,5,6 - SERC**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Duane Franke - Manitoba Hydro - 1,3,5,6 - MRO**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**David Vickers - David Vickers On Behalf of: Daniel Roethemeyer, Vistra Energy, 5; - David Vickers**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Donna Wood - Tri-State G and T Association, Inc. - 1**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Cain Braveheart - Bonneville Power Administration - 1,3,5,6 - WECC**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Jessica Cordero - Unisource - Tucson Electric Power Co. - 1**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Tim Kelley - Tim Kelley On Behalf of: Charles Norton, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Fong Mua, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Kevin Smith, Balancing Authority of Northern California, 1; Nicole Looney, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Ryder Couch, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Wei Shao, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; - Tim Kelley, Group Name SMUD and BANC**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Casey Jones - Berkshire Hathaway - NV Energy - 5 - WECC**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Hayden Maples - Hayden Maples On Behalf of: Jeremy Harris, Evergy, 3, 5, 1, 6; Kevin Frick, Evergy, 3, 5, 1, 6; Marcus Moor, Evergy, 3, 5, 1, 6; Tiffany Lake, Evergy, 3, 5, 1, 6; - Hayden Maples**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Adam Burlock - Adam Burlock On Behalf of: Ashley Scheelar, TransAlta Corporation, 5; - Adam Burlock**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Ruchi Shah - AES - AES Corporation - 5**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Anna Martinson - MRO - 1,2,3,4,5,6 - MRO, Group Name MRO Group**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Gail Elliott - Gail Elliott On Behalf of: Michael Moltane, International Transmission Company Holdings Corporation, 1; - Gail Elliott**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Israel Perez - Israel Perez On Behalf of: Laura Somak, Salt River Project, 3, 6, 5, 1; Mathew Weber, Salt River Project, 3, 6, 5, 1; Thomas Johnson, Salt River Project, 3, 6, 5, 1; Timothy Singh, Salt River Project, 3, 6, 5, 1; - Israel Perez**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Benjamin Widder - MGE Energy - Madison Gas and Electric Co. - 3**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Greg Sorenson - Greg Sorenson On Behalf of: Tyler Schwendiman, ReliabilityFirst , 10; - Greg Sorenson**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**



**Mohamad Elhousseini - DTE Energy - Detroit Edison Company - 5**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Scott Thompson - PNM Resources - Public Service Company of New Mexico - 1,3,5 - WECC**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Mike Magruder - Avista - Avista Corporation - 1**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Jodirah Green - ACES Power Marketing - 1,3,4,5,6 - MRO,WECC,Texas RE,SERC,RF, Group Name ACES Collaborators**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Bob Cardle - Bob Cardle On Behalf of: Marco Rios, Pacific Gas and Electric Company, 3, 1, 5; Sandra Ellis, Pacific Gas and Electric Company, 3, 1, 5; Tyler Brun, Pacific Gas and Electric Company, 3, 1, 5; - Bob Cardle**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Jennifer Bray - Arizona Electric Power Cooperative, Inc. - 1**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Martin Sidor - NRG - NRG Energy, Inc. - 6**

**Answer**

**Document Name**

**Comment**

NRG agrees with and refers the SDT to the EPSA comments.

Likes 0

Dislikes 0

**Response**

**Charles Yeung - Southwest Power Pool, Inc. (RTO) - 2 - MRO,WECC,Texas RE,NPCC,SERC,RF, Group Name SRC 2024**

**Answer**

**Document Name****Comment**

In the proposed definition of “Ride-through”, the ISO/RTO Council (IRC) Standards Review Committee (SRC) believes that the requirement that a facility continue “to operate” is inadequate; the definition needs to require the facility to maintain performance that is beneficial (or at the very least, not detrimental) to overall grid reliability.

It is preferable if the ride-through definition referred to the electric system instead of the BPS to be consistent with the IBR definition.

Finally, the concept of ride-through needs to recognize that the continued operation associated with ride-through needs to be maintained not just through the Disturbance but all the way through recovery to a new operating point. It is not clear that the existing Disturbance definition includes the recovery period.

To address these concerns, the ride-through definition could be revised to read as follows:

“Ride-through: The entire plant/facility remaining connected to the electric system and continuing in its entirety to operate in a manner that supports grid reliability through a System Disturbance, including the period of recovery back to a normal operating condition.”

Likes 0

Dislikes 0

**Response**

**Marty Hostler - Northern California Power Agency - 3,4,5,6**

**Answer**

**Document Name**

**Comment**

NCPA is not registered to vote on this item and thus is not opposing it or FERC Order 901.

Likes 0

Dislikes 0

**Response**

**2. Do you agree with the changes made in this draft of PRC-029-1?**

**Jennifer Neville - Western Area Power Administration - 1,6**

**Answer** No

**Document Name**

**Comment**

Support MRO NSRF comments

Likes 0

Dislikes 0

**Response**

**Marty Hostler - Northern California Power Agency - 3,4,5,6**

**Answer** No

**Document Name**

**Comment**

We don't know if this proposal is going to improve reliability or the extent of reliability improvement, if any. The SDT has not shown us tangible reliability improvement indices that support the modifications made. Considering this standard has been changed several times over the last few years we are skeptical that changes made will improve reliability. However, we do not oppose the proposal.

Likes 0

Dislikes 0

**Response**

**Srinivas Kappagantula - Arevon Energy - 5**

**Answer** No

**Document Name**

**Comment**

Please see SEIA and NAGF comments on these standards. Lack of exemptions for frequency ride through requirements especially for older legacy IBR facilities is critically important as some of these plants may not be able to comply with this standard.

Likes 0

Dislikes 0

**Response**

**Jennifer Bray - Arizona Electric Power Cooperative, Inc. - 1**

**Answer** No

**Document Name**

**Comment**

AEPC signed on to ACES comments:

It is the opinion of ACES that the definition of what constitutes an IBR should be consistent across the industry. The Project 2020-02 SDT has been working diligently towards this goal and we do not believe that an individual standard should deviate from their approach. Thus we recommend removing the phrase “The Elements associated with” from section 4.2 and modifying this section as follows:

4.2. Facilities:

4.2.1. Bulk Electric System (BES) IBRs; and

4.2.2. Non-BES IBRs that either have or contribute to an aggregate nameplate capacity of greater than or equal to 20 MVA, connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage greater than or equal to 60 kV.

R1. ACES believes that phrase “and is initiated by a non-fault switching event on the transmission system” should be struck from the 3rd bullet point of Requirement R1. It is our opinion that the GO will likely be unable to differentiate between an event initiated by a fault or an event initiated by a “non-fault switching event” on the Transmission system. In short, Transmission switching events are outside the purview of the GO.

R3/R4. ACES has grave concerns with the lack of any exceptions to Requirement R3 for existing IBRs. It is our opinion that Requirements R3 and R4 should be modified to include an exception for an IBR that is in-service by the effective date of PRC-029-1 and has a known hardware limitation that prevents the IBR from meeting Frequency Ride-through criteria.

R4. Lastly, it is ACES opinion that the acronym “CEA” should be spelled out in the first use within PRC-029-1 so as to eliminate any confusion as to what this term means. “CEA” is not a defined term and while it used in the NERC Rules of Procedure, it is not commonly used within the Reliability Standards.

Likes 0

Dislikes 0

**Response**

**George E Brown - Pattern Operators LP - 5**

**Answer** No

**Document Name**

**Comment**

Pattern Energy supports Edison Electric Institute’s and Grid Strategies LLC’s comments.

Likes 0

Dislikes 0

**Response**

**Bob Cardle - Bob Cardle On Behalf of: Marco Rios, Pacific Gas and Electric Company, 3, 1, 5; Sandra Ellis, Pacific Gas and Electric Company, 3, 1, 5; Tyler Brun, Pacific Gas and Electric Company, 3, 1, 5; - Bob Cardle**

**Answer**

No

**Document Name**

**Comment**

PGAE recommends R3 and R4 to be revised to allow for existing IBR facility limitations for Frequency Ride Through, similar to the approach in R1 and R2.

Likes 0

Dislikes 0

**Response**

**Jodirah Green - ACES Power Marketing - 1,3,4,5,6 - MRO,WECC,Texas RE,SERC,RF, Group Name ACES Collaborators**

**Answer**

No

**Document Name**

**Comment**

It is the opinion of ACES that the definition of what constitutes an IBR should be consistent across the industry. The Project 2020-06 SDT has been working diligently towards this goal and we do not believe that an individual standard should deviate from their approach. Thus we recommend removing the phrase "The Elements associated with" from section 4.2 and modifying this section as follows:

4.2. Facilities:

4.2.1. Bulk Electric System (BES) IBRs; and

4.2.2. Non-BES IBRs that either have or contribute to an aggregate nameplate capacity of greater than or equal to 20 MVA, connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage greater than or equal to 60 kV.

R1. ACES believes that phrase "and is initiated by a non-fault switching event on the transmission system" should be struck from the 3rd bullet point of Requirement R1. It is our opinion that the GO will likely be unable to differentiate between an event initiated by a fault or an event initiated by a "non-fault switching event" on the Transmission system. In short, Transmission switching events are outside the purview of the GO.

R3/R4. ACES has grave concerns with the lack of any exceptions to Requirement R3 for existing IBRs. It is our opinion that Requirements R3 and R4 should be modified to include an exception for an IBR that is in-service by the effective date of PRC-029-1 and has a known hardware limitation that prevents the IBR from meeting Frequency Ride-through criteria.

R4. Lastly, it is ACES opinion that the acronym "CEA" should be spelled out in the first use within PRC-029-1 so as to eliminate any confusion as to what this term means. "CEA" is not a defined term and while it used in the NERC Rules of Procedure, it is not commonly used within the Reliability Standards.

Likes 0

Dislikes 0

**Response**

**Rhonda Jones - Invenergy LLC - 5**

**Answer**

No

**Document Name**

**Comment**

Invenergy has the following comments regarding this draft of PRC-029-1:

R1: Bullet 3 presents significant challenges, and it is unclear how an entity would demonstrate compliance with the design aspect of PRC-029-1. Generator Owners will likely not be able to properly model the non-fault switching event condition and would thus be unable to independently assure design adherence to that requirement.

Remove “in whole or part” from Footnote 7 and Footnote 10. As drafted, the footnotes are inconsistent with IEEE-2800.

Attachment 1 bullet 10 must be removed or significantly amended. Some protection decisions must be made in a matter of micro-seconds, and as drafted, bullet 10 would adversely impact reliability by subjecting equipment to potentially damaging surges of current or voltage that near instantaneous protection settings are designed to mitigate.

Invenergy disagrees with the SDT’s interpretation of FERC Order 901, and we would like to reiterate that there is no clear evidentiary record to support the exclusion of limited exceptions from the frequency ride-through requirements. What’s most concerning however is the SDT’s recent assertion that it “does not have sufficient data at this time to determine whether additional frequency-based exemptions are appropriate and consistent with the overall reliability goals of Order No. 901.” We continue to await the requested technical justification studies and would like to direct the SDT to the several public comments filed by OEMs in ERCOT’s NOGRR 245 proceeding, that illustrate equipment challenges to meet reasonable data driven ride-through capability limits that fall below the current draft of PRC-029-1.

- **GE**

[245NOGRR-58 GE Vernova Comments 110723.doc \(live.com\)](#)

[245NOGRR-63 GE Vernova Comments 011924.docx \(live.com\)](#)

- **Vestas**

[245NOGRR-57 Vestas Comments 110123.doc \(live.com\)](#)

- **Siemens Gamesa**

[245NOGRR-56 Siemens Gamesa Renewable Energy Comments 103023.docx \(live.com\)](#)

Additionally, the SDT and NERC are encouraged to leverage the industry provided information regarding equipment limitations submitted according to provisions in the currently effectively Reliability Standard PRC-024-3.

As written, Draft 3 of PRC-029-1 ignores the technical realities surrounding many gigawatts of inverter-based resources installed on the BES today and **provides no path to compliance** for entities with well documented and understood hardware limitations. Invenergy would like to remind NERC that FERC has on many occasions, including within Order 901, granted NERC the leeway to exercise its technical expertise, experience, and discretion to develop appropriate requirements.

A reasonable path to compliance for facilities with equipment that is unable to meet the proposed voltage or frequency ride-through requirements would be to retain and carry over R3 from PRC-024-4. This would ensure equitable treatment of all generation types, provide sensible accommodations for equipment limitations, and push facilities to maximize their capabilities to the extent possible. In fact, FERC alluded to that in paragraph 193 of Order 901, stating, “We encourage NERC’s standard drafting team to consider currently effective Reliability Standard PRC-024-3, Requirement R3 as an example for establishing registered IBR technology exemptions.”

Absent limited exemptions from the ride-through requirements or a clear path to compliance for entities with hardware limitations, the frequency bands must be amended. To date, the SDT has provided no evidence that the proposed frequency bands, well beyond those of IEEE-2800-2002, would benefit BES reliability.

Likes	0
Dislikes	0



Response	
Colin Chilcoat - Invenergy LLC - 6	
Answer	No
Document Name	
Comment	

Invenergy has the following comments regarding this draft of PRC-029-1:

R1: Bullet 3 presents significant challenges, and it is unclear how an entity would demonstrate compliance with the design aspect of PRC-029-1. Generator Owners will likely not be able to properly model the non-fault switching event condition and would thus be unable to independently assure design adherence to that requirement.

Remove “in whole or part” from Footnote 7 and Footnote 10. As drafted, the footnotes are inconsistent with IEEE-2800.

Attachment 1 bullet 10 must be removed or significantly amended. Some protection decisions must be made in a matter of micro-seconds, and as drafted, bullet 10 would adversely impact reliability by subjecting equipment to potentially damaging surges of current or voltage that near instantaneous protection settings are designed to mitigate.

Invenergy disagrees with the SDT’s interpretation of FERC Order 901, and we would like to reiterate that there is no clear evidentiary record to support the exclusion of limited exceptions from the frequency ride-through requirements. What’s most concerning however is the SDT’s recent assertion that it “does not have sufficient data at this time to determine whether additional frequency-based exemptions are appropriate and consistent with the overall reliability goals of Order No. 901.” We continue to await the requested technical justification studies and would like to direct the SDT to the several public comments filed by OEMs in ERCOT’s NOGRR 245 proceeding, that illustrate equipment challenges to meet reasonable data driven ride-through capability limits that fall below the current draft of PRC-029-1.

## GE

[245NOGRR-58 GE Vernova Comments 110723.doc \(live.com\)](#)

[245NOGRR-63 GE Vernova Comments 011924.docx \(live.com\)](#)

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Additionally, the SDT and NERC are encouraged to leverage the industry provided information regarding equipment limitations submitted according to provisions in the currently effectively Reliability Standard PRC-024-3.

As written, Draft 3 of PRC-029-1 ignores the technical realities surrounding many gigawatts of inverter-based resources installed on the BES today and **provides no path to compliance** for entities with well documented and understood hardware limitations. Invenergy would like to remind NERC that FERC has on many occasions, including within Order 901, granted NERC the leeway to exercise its technical expertise, experience, and discretion to develop appropriate requirements.

A reasonable path to compliance for facilities with equipment that is unable to meet the proposed voltage or frequency ride-through requirements would be to retain and carry over R3 from PRC-024-4. This would ensure equitable treatment of all generation types, provide sensible accommodations for equipment limitations, and push facilities to maximize their capabilities to the extent possible. In fact, FERC alluded to that in paragraph 193 of Order 901, stating, “We encourage NERC’s standard drafting team to consider currently effective Reliability Standard PRC-024-3, Requirement R3 as an example for establishing registered IBR technology exemptions.”

Absent limited exemptions from the ride-through requirements or a clear path to compliance for entities with hardware limitations, the frequency bands must be amended. To date, the SDT has provided no evidence that the proposed frequency bands, well beyond those of IEEE-2800-2002, would benefit BES reliability.

Likes	0
Dislikes	0

**Response**

**Mike Magruder - Avista - Avista Corporation - 1**

**Answer** No

**Document Name**

**Comment**

We concur with EEI's comments.

Likes 0

Dislikes 0

**Response**

**Steven Taddeucci - NiSource - Northern Indiana Public Service Co. - 3**

**Answer** No

**Document Name**

**Comment**

NIPSCO recommends removing the phrase “demonstrate the design of each facility” from the proposed standard and returning to the original event-based requirements. The phrase may prove difficult to fully comply with, as a Functional Entity would have to know the design of the collector system and parameters and run the models correctly to demonstrate this. Much of this needed information would need to be provided by the manufacturer, which may require non-disclosure agreements.

Please clarify or remove “other mechanisms” from requirement R2.

Likes 0

Dislikes 0

**Response**

**Carver Powers - Utility Services, Inc. - 4**

**Answer** No

**Document Name**

**Comment**

Requirement 2.1.1 through 2.1.3 are all required, recommend ensuring consistency in formatting and include an “and” at the end of 2.1.2.

Request clarification of the intent of 2.1.3. The proposed language is not written clearly, and the intent is not apparent. Recommend at a minimum addressing this sub-requirement in the technical rationale. An additional recommendation is to provide clarification on how requirement 2.1.3 relates to the tables in Attachment 1.

Likes 0

Dislikes 0

### Response

**Christine Kane - WEC Energy Group, Inc. - 3, Group Name WEC Energy Group**

**Answer**

No

**Document Name**

**Comment**

R3. Wording “...and the absolute rate of change of frequency (RoCoF) magnitude is less than or equal to 5 Hz/second.” should be removed from R3. The rate of change of frequency has never been an issue in past IBR disturbances. In addition, PRC-024 does not mention and includes rate of change of frequency requirements. There is no technical rationale for this.

R3. Requirement should include exceptions due to hardware limitation, the same exception that was given for voltage requirements. WEC Energy Group owns a wind farm with frequency limitation that may not meet PRC-029 requirements. Please explain what should we do? Do not overlook limited capabilities of older Type 3 wind IBRs. WEC Energy Group recognized similar concerns commented by industry, please address it.

WEC Energy Group suggests SDT to create and add graphs for support Tables 1 and 2 and the respective notes. Graphs should highlight “must Ride through zone” and “may Ride through zone” terms that are listed in note 11.

Likes 0

Dislikes 0

### Response

**Selene Willis - Edison International - Southern California Edison Company - 5**

**Answer**

No

**Document Name**

**Comment**

"Please see EEI Comments"

Likes 0

Dislikes 0

### Response

Answer No

Document Name [2020-02 LG&E KU Comments.docx](#)

**Comment**

Please see the attached comments.

Likes 0

Dislikes 0

**Response**

**Kristine Martz - Edison Electric Institute - NA - Not Applicable - NA - Not Applicable**

Answer No

Document Name

**Comment**

EEI does not support the approval of PRC-029-1 because it intends to require existing resources to meet the frequency performance standards mandated in Requirement R3 and provides no mechanism for IBR resource owners to declare a technical exemption consistent with voltage ride-through requirements contained in Requirements R1 and R2. It is EEI’s understanding that this was done because the drafting team (DT) understood that the FERC Order did not allow any exemption for frequency ride-through requirements. However, in Paragraph 193 of FERC Order No. 901, the Commission expressly directed NERC to determine through its standards development process whether the Reliability Standards mandated therein should include a limited exemption for certain IBRs from voltage ride-through performance requirements. Importantly, the Commission, in Order No. 901 did not concomitantly prohibit the inclusion of a similar exemption from frequency ride-through performance requirements, either expressly or implicitly. Rather, it left that decision firmly in the hands of subject matter experts, as was made evident when it encouraged “NERC’s standard drafting team to consider currently effective Reliability Standard PRC-024-3, Requirement R3 **as an example for establishing registered IBR technology exemptions.**” *Reliability Standards to Address Inverter-Based Resources*, Order No. 901, 185 FERC ¶ 61,042, at P 193 (2022) (emphasis added).

EEI further notes that we are unaware of any frequency ride-through events, beyond equipment control setting errors, that have been documented and cited in any of the NERC Event reports to justify a need to disallow reasonable equipment exemptions for IBRs that cannot meet the proposed frequency ride-through requirements. Nevertheless, PRC-029-1 contains requirements for frequency ride-through that are likely infeasible to implement through either hardware or software means, in many cases for existing resources. (Noting that while software upgrades might be a viable option for some newer IBRs, software solutions for older resources would not be a viable remedy because many of the older resources would not have the computing capability necessary to support such upgrades.)

To address our concerns, we recommend the following:

1. Change PRC-029-1 to include reasonable and justified exemptions for legacy IBR facilities. *(See edits to R4 below)*
2. Align the Frequency ride-through curve in PRC-029-1 with IEEE 2800-2022. *(Align Table 3 of attachment 2 to IEEE 2800-2022)*

**PRC-029-1 (Requirement R4 – Changes in Boldface)**

**R4.** Each Generator Owner identifying an IBR that is in-service by the effective date of PRC-029-1, has known hardware limitations that prevent the IBR from meeting voltage **and frequency** Ride-through criteria as detailed in Requirements R1, R2, **and R3** and requires an exemption from specific Ride-through criteria shall: *10 Lower* [Time Horizon: Long-term Planning]

**4.1.** Document information supporting the identified hardware limitation no later than 12 months following the effective date of PRC-029-1. This documentation shall include:

- 4.1.1** Identifying information of the IBR (name and facility #);
- 4.1.2** Which aspects of voltage **or frequency** Ride-through requirements that the IBR would be unable to meet and the capability of the hardware due to the limitation;
- 4.1.3** Identify the specific piece(s) of hardware causing the limitation;
- 4.1.4** Supporting technical documentation verifying the limitation is due to hardware that needs to be physically replaced or that the limitation cannot be removed by software updates or setting changes, and;
- 4.1.5** Information regarding any plans to remedy the hardware limitation (such as an estimated date).
- 4.2.** Provide a copy of the information detailed in Requirement R4.1 to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), Reliability Coordinator(s), and the CEA no later than 12 months following the effective date of PRC-029-1.
- 4.2.1** Any response to additional information requested by the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), Reliability Coordinator(s), and the CEA shall be provided back to the requestor within 90 days of the request.
- 4.2.2** Provide a copy of the acceptance of a hardware limitation by the CEA to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s).<sup>11</sup>
- 4.3.** Each Generator Owner with a previously accepted limitation that replace the hardware causing the limitation shall document and communicate such a hardware change to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s) within 90 days of the hardware change.
- 4.3.1** When existing hardware causing the limitation is replaced, the exemption for that Ride-through criteria no longer applies.

Likes	0
Dislikes	0

**Response**

**Stephanie Kenny - Edison International - Southern California Edison Company - 6**

<b>Answer</b>	No
<b>Document Name</b>	

**Comment**

See EEI Comments

Likes	0
Dislikes	0

**Response**

**Kimberly Turco - Constellation - 6**

<b>Answer</b>	No
<b>Document Name</b>	

## Comment

Constellation aligns with NAGF comments.

Kimberly Turco on behalf of Constellation Energy Segments 5 and 6.

Likes 0

Dislikes 0

## Response

**Richard Vendetti - NextEra Energy - 5**

**Answer**

No

**Document Name**

## Comment

Facilities:

4.2.1. The Elements associated with (1) Bulk Electric System (BES) IBRs inverter-based resources and (2) Non-BES IBRs that either have or contribute to an aggregate nameplate capacity of greater than or equal to 20 MVA, connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage greater than or equal to 60 kV

NextEra aligns with EEI's recommendation to remove "elements associated with" from Section 4.2.1

R1 and R2

NextEra believes that further clarity on reporting could be added to R1 and R2 consistent with the technical rationale.

R3

With a large portion of wind fleet across multiple OEMS, NextEra recommends there be an exception process for R3, or that it should not be applied retroactively. This is a particular concern for entrants for the Non-BES Assets.

R4

NextEra aligns with the below comments provided from EEI:

EEI does not agree with imposing new unverified requirements on existing resources as proposed in PRC-029-1 because it is unclear how many existing resources can meet the frequency performance standards mandated in Requirement 3. We are additionally concerned because resource owners have not been given adequate time to fully assess the impact of imposing these new requirements on their existing resources, which align with IEEE 2800-2022 (See 7.3.2.1 Figure 12 & Table 15 (Frequency ride-through, page 80; and see 7.3.2.3.5 Rate of change of frequency (ROCOF), page 82), and did not exist as a Standard until February 2022, after most of these resources were built or placed in service. For this reason, we cannot support the approval of PRC-029-1 without the following changes to Requirement 4 ensure that existing resources that were not design and do not have the capability to meet these requirements are allowed to declare an exemption for frequency ride-through similar to what is provided for resources that cannot meet the voltage ride-through requirements. See the proposed changes to R4 in boldface below:

**R4.** Each Generator Owner identifying an IBR that is in-service by the effective date of PRC-029-1, has known hardware limitations that prevent the IBR from meeting voltage **and frequency** Ride-through criteria as detailed in Requirements R1, **and** R2, **and** R3 and requires an exemption from specific **voltage** Ride-through criteria shall: [10 Lower](#) [Time Horizon: Long-term Planning]

**4.1.** Document information supporting the identified hardware limitation no later than 12 months following the effective date of PRC-029-1. This documentation shall include:

**4.1.1** Identifying information of the IBR (name and facility #);

**4.1.2** Which aspects of voltage **or frequency** Ride-through requirements that the IBR would be unable to meet and the capability of the hardware due to the limitation;

{C}**4.1.3** Identify the specific piece(s) of hardware causing the limitation;

**4.1.4** Supporting technical documentation verifying the limitation is due to hardware that needs to be physically replaced or that the limitation cannot be removed by software updates or setting changes, and;

**4.1.5** Information regarding any plans to remedy the hardware limitation (such as an estimated date).

**4.2.** Provide a copy of the information detailed in Requirement R4.1 to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), Reliability Coordinator(s), and the CEA no later than 12 months following the effective date of PRC-029-1.

**4.2.1** Any response to additional information requested by the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), Reliability Coordinator(s), and the CEA shall be provided back to the requestor within 90 days of the request.

**4.2.2** Provide a copy of the acceptance of **an a** hardware limitation by the CEA to the associated Planning Coordinator(s), Transmission Planner (s), Transmission Operator(s), and Reliability Coordinator(s).[11](#)

**4.3.** Each Generator Owner with a previously accepted limitation that replace the hardware causing the limitation shall document and communicate such a hardware change to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s) within 90 days of the hardware change.

**4.3.1** When existing hardware causing the limitation is replaced, the exemption for that Ride-through criteria no longer applies.

Footnote 7

“Available Real Power” is not NERC defined term located in the NERC Glossary of Terms. By adding to the footnote, this creates confusion.

NextEra recommends defining and adding to NERC Glossary.

Likes 0

Dislikes 0

### Response

**Megan Melham - Decatur Energy Center LLC - 5**

**Answer**

No

**Document Name**

**Comment**



Capital Power supports the NAGF's comments:

*The NAGF strongly recommends that PRC-029 be revised to allow for frequency ride through ("FRT") exemptions to address such limitations for legacy IBR facilities. Not including FRT exemptions will result in a standard that will make certain IBR legacy facilities automatically non-compliant when the standards become effective.*

*Requirement R3 – the NAGF is concerned that legacy IBR facilities are not capable of meeting the 5 Hz/second maximum ROCOF or the 25-degree phase angle jump requirements. Therefore, FRT exemptions are necessary and need to be included in Requirement R3. In support of this concern, the NAGF points to the ERCOT NOGRR245 TAC Presentation, December 4, 2023 – page 4 which indicates that 40% of OEMs cannot comply with the previously proposed specific 5 Hz/second maximum ROCOF requirement and 41% of OEMs cannot comply with the previously proposed specific 25-degree phase angle jump requirement.*

[December 4 2024 NOGRR245 TAC Stephen Solis - Principal System Operations Improvement](#)

*Requirement R4.2.2 – the NAGF is unclear as to what the Compliance Enforcement Authority (CEA) acceptance for an IBR hardware limitation exemption will consist of. Will the CEA provide an email response confirming acceptance to the Generator Owner submitting the exemption? How are such exemptions to be submitted and to whom within the CEA organization?*

In addition to the NAGF comments above, after discussions with a wind turbine OEM, some legacy equipment will not be able to handle the 64 Hz overfrequency ride-through requirement stipulated in PRC-029. Requiring IBRs to ride through an overfrequency in the range of 61.8 Hz to 64 Hz is beyond the IEEE 2800 standard, as stated by the SDT within the technical rationale. We recommend aligning the frequency ride-through requirement to be more in line with the IEEE 2800 standard and reducing the final "no-trip" overfrequency requirement to 61.8Hz in addition to changing the wording of Requirement R4 to allow for FRT exemptions. More discussions with IBR OEMs must be held to confirm equipment capabilities.

Likes 0

Dislikes 0

### Response

**Alison MacKellar - Constellation - 5**

**Answer**

No

**Document Name**

**Comment**

Constellation aligns with NAGF comments.

Alison Mackellar on behalf of Constellation Segments 5 and 6

Likes 0

Dislikes 0

### Response

**Wayne Sipperly - North American Generator Forum - 5 - MRO,WECC,Texas RE,NPCC,SERC,RF**

**Answer**

No

**Document Name**

**Comment**

The NAGF strongly recommends that PRC-029 be revised to allow for frequency ride through (“FRT”) exemptions to address such limitations for legacy IBR facilities. Not including FRT exemptions will result in a standard that will make certain IBR legacy facilities automatically non-compliant when the standards become effective.

Requirement R3 – the NAGF is concerned that legacy IBR facilities are not capable of meeting the 5 Hz/second maximum ROCOF or the 25-degree phase angle jump requirements. Therefore, FRT exemptions are necessary and need to be included in Requirement R3. In support of this concern, the NAGF points to the ERCOT NOGRR245 TAC Presentation, December 4, 2023 – page 4 which indicates that 40% of OEMs cannot comply with the previously proposed specific 5 Hz/second maximum ROCOF requirement and 41% of OEMs cannot comply with the previously proposed specific 25-degree phase angle jump requirement.

[December 4 2024 NOGRR245 TAC Stephen Solis - Principal System Operations Improvement](#)

The NAGF recommends aligning exception language with IEEE-2800. The proposed PRC-029 ride through requirements do not include the technology limitations discussed in IEEE-2800.

Requirement R4.2.2 – the NAGF is unclear as to what the Compliance Enforcement Authority (CEA) acceptance for an IBR hardware limitation exemption will consist of. Will the CEA provide an email response confirming acceptance to the Generator Owner submitting the exemption? How are such exemptions to be submitted and to whom within the CEA organization?

Likes 0

Dislikes 0

**Response**

**Ruchi Shah - AES - AES Corporation - 5**

**Answer**

No

**Document Name**

**Comment**

- AES CE believes additional changes are needed as explained below.

Likes 0

Dislikes 0

**Response**

**Adam Burlock - Adam Burlock On Behalf of: Ashley Scheelar, TransAlta Corporation, 5; - Adam Burlock**

**Answer**

No

**Document Name**

**Comment**

TransAlta supports multiple other organizations who recommend the addition of frequency ride-through to the allowable hardware limitations in R4.

Likes 0

Dislikes 0

## Response

**Hayden Maples - Hayden Maples On Behalf of: Jeremy Harris, Evergy, 3, 5, 1, 6; Kevin Frick, Evergy, 3, 5, 1, 6; Marcus Moor, Evergy, 3, 5, 1, 6; Tiffany Lake, Evergy, 3, 5, 1, 6; - Hayden Maples**

Answer

No

Document Name

## Comment

Evergy supports and incorporates by reference the comments of the Edison Electric Institute (EEI) on question 2

Likes 0

Dislikes 0

## Response

**Michael Goggin - Grid Strategies LLC - 5**

Answer

No

Document Name

## Comment

In the current draft of PRC-029, R4 should be modified to allow existing resources with equipment limitations to obtain an exemption from the frequency ride-through requirements in R3, instead of only allowing an exemption from the voltage ride-through requirements in R1 and R2. This is necessary because most existing IBR generators cannot meet the stringent frequency ride-through requirements proposed in R3 without deploying significant hardware modifications or replacement, which goes against the intent of FERC Order 901.

Without change, a large share of the 270 GW of operating IBR plants,[\[1\]](#) representing an investment of hundreds of billions of dollars, will be forced into early retirement. Abruptly forcing such a large volume of existing generators offline would not only impose massive costs, but also cause generation shortfalls in many regions. Such drastic action could be understandable if the frequency ride-through requirement were addressing a real reliability concern. However, NERC and the drafting team have repeatedly been unable to provide any technical justification for imposing the frequency ride-through requirement existing IBR plants. None of the reports NERC has published in response to IBR ride-through events have identified frequency ride-through as a significant concern. There is no reason to impose such a massive cost and reliability impact for a solution in search of a problem.

Information provided by the two largest IBR owners in the U.S. confirms that most existing IBRs cannot meet the frequency ride-through requirements. One of these developers indicated that more than 30% of its fleet could not comply with the draft standard. The other indicated that half of its operating IBR fleet has no viable path to compliance, and a large share of the remainder will require cost-prohibitive retrofits, so if the standard went into effect as drafted a large share of its operating fleet will have to be retired or fully repowered. Other developers that operate the remainder of the 270 GW IBR fleet would likely see comparable impacts. Retiring, or at best taking out of service for an extended period of time for repowering, such a large volume of facilities during a time of rapid growth in peak load and energy needs would cause far greater reliability concerns than whatever concern the frequency ride-through requirement is attempting to address.

Information provided by these developers indicates that a large share of wind, solar, and battery resources cannot meet the frequency ride-through standard without significant hardware replacement. The frequency ride-through requirements are particularly problematic for some existing wind generators. In the Technical Rationale document accompanying the second PRC-029 draft, the drafting team notes that some wind generators are more sensitive to frequency deviations, writing that "All IBR resources (except for type 3 wind turbines) interface to the grid through fast switching of power electronics devices. These power electronic devices are much less sensitive to the transmission system frequency excursion than non-hydraulic turbine

resources.”<sup>[2]</sup> However, the drafting team incorrectly concludes that “Therefore, IBR should be capable of riding through the increased proposed 6-second frequency ride-through requirement without risk of equipment damage or need for frequency protection to operate.” The Technical Rationale document does not offer any justification for its assumption that Type III wind turbines can meet the frequency ride-through requirements, despite noting that those turbines more directly interface with the grid and thus are more affected by frequency deviations than other IBRs.

In fact, many existing Type III wind turbines cannot meet the frequency ride-through requirements proposed in this draft of PRC-029. Those resources were designed to meet the reliability Standards and interconnection requirements that were in effect when they were placed in service, and were not designed to ride through frequency excursions of the magnitude and duration proposed in the draft Standard. Imposing a retroactive requirement on these generators is particularly problematic as it is not typically feasible to retrofit existing wind turbines to increase their ability to withstand mechanical stresses due to frequency changes. In such cases, making existing equipment better able to withstand frequency changes would require full replacement or extensive modification of hardware, which would come at a significant, and sometimes prohibitive, cost. At minimum, bringing wind plants that cannot meet the current standard into compliance would require replacing the turbine converter and controller. Further, frequency changes can impose mechanical stresses on highly sensitive elements in the wind turbine’s rotating equipment, including the generator, gearbox, the main shaft, and bearings associated with all of that equipment, and requiring such resources to ride through frequency changes they were not designed to operate through can damage that equipment. Subjecting Type III wind turbines to this damage may lead to increased outages or premature failure of these generators, potentially increasing reliability risks. As noted above, if the standard went into effect as drafted a large share of the operating IBR fleet will have to be retired or fully repowered. Retiring these facilities during a time of rapid growth in peak load and energy needs would cause far greater reliability concerns than whatever concern the frequency ride-through requirement is attempting to address.

### **The Solution: Frequency ride-through exemptions for existing IBRs**

The easiest solution is to modify R4 to allow existing resources with equipment limitations to obtain an exemption from the frequency ride-through requirements in R3, which would make PRC-029 consistent with a long precedent of FERC interconnection requirements and NERC Standards only applying prospectively, including PRC-024. Retroactive requirements impose a much greater financial burden on the generator than prospective Standards, and set a bad precedent by unfairly penalizing generators that met all requirements that were in effect at the time they were installed. Retrofit or replacement costs are typically much greater than if the capability were installed at the plant to begin with. In some cases parts needed for retrofits may not be available, particularly for models that have been discontinued or manufacturers that are no longer in business, potentially requiring the replacement of the entire power conversion system. Moreover, existing IBR generators typically sell their output at a fixed price under a long-term power purchase agreement, and unexpected retrofit or replacement costs cannot typically be recovered once a power purchase agreement has been signed. These unexpected and unrecoverable costs are far more concerning to lenders and other generation project financiers as they were not accounted for during the project’s financing. As a result, retroactive requirements set a bad precedent by introducing regulatory uncertainty that makes future generation investment more uncertain and riskier, and likely more costly by forcing financiers to charge higher risk premiums. Changing the rules in the middle of the game and penalizing resources that were designed to the standards in effect at the time they were built also establishes a bad precedent, in addition to imposing costs that are not just and reasonable and undue discrimination relative to resources covered by PRC-024.

Fortunately, these problems can be fixed by simply inserting “R3” into the list of permissible exemptions in R4, which would allow existing resources with equipment limitations to obtain an exemption from the frequency ride-through requirements in R3.

In the Technical Rationale document, the drafting team points to FERC’s directive in Order No. 901 to justify not allowing existing resources to obtain an exemption from the frequency ride-through requirements in R3: “FERC Order No. 901 states that this provision would be limited to exempting ‘certain registered IBRs from voltage ride-through performance requirements.’ This is the reason that no similar provisions are included for exemptions for frequency or rate-of-change-of-frequency (ROCOF) ride-through requirements per R3.”<sup>[3]</sup>

However, a contextual reading of Order No. 901 indicates FERC was focused on targeting equipment limitation exemptions at existing generators that would have to physically replace or modify hardware to comply with the Standard, and not focused on limiting such exemptions to voltage ride-through requirements. Paragraph 193 in its entirety, and particularly the first sentence, explain that FERC’s intent was exempting existing resources that would have to physically replace or modify hardware: “we agree that a subset of existing registered IBRs –typically older IBR technology with hardware that needs to be physically replaced and whose settings and configurations cannot be modified using software updates – may be unable to implement the voltage ride through performance requirements directed herein.” As a result, FERC continued by directing that “Any such exemption should be only for voltage ride-through performance for those existing IBRs that are **unable to modify their coordinated protection and control settings to meet the requirements without physical modification of the IBRs’ equipment.**”<sup>[4]</sup>

Allowing existing plants to apply for an equipment limitation exemption for the frequency ride-through requirements in R3 is necessary to ensure some existing generators do not have to physically replace or modify hardware, as explained above. As a result, such an exemption is consistent with FERC’s

directive in Order No. 901. As documented in the following footnote, there is ample precedent for NERC and standards drafting teams to exercise their technical expertise to craft Standards to align content and requirements with technical realities.<sup>[5]</sup>

Additional context in Order 901 further demonstrates that FERC intended for NERC to include an exemption for existing IBRs that cannot meet frequency ride-through requirements. At paragraph 190 in Order No. 901, FERC directed NERC to develop Standards that ensure resources “ride through frequency and voltage system disturbances and that permit IBR tripping only to protect the IBR equipment in scenarios similar to when synchronous generation resources use tripping as protection from internal faults.” For many existing IBRs that cannot meet the proposed frequency ride-through requirements, tripping is necessary to protect the IBR equipment, similar to when synchronous generation resources use tripping as protection from internal faults. As a result, an exemption from R3 for existing resources is consistent with FERC’s intent. Order No. 901 also directed NERC to consider the “PRC-024-3, Requirement R3 as an example for establishing registered IBR technology exemptions,” and that exemption applies equally to voltage ride-through and frequency ride-through settings, further suggesting that FERC will allow certain IBRs an exemption from the frequency ride-through requirements.<sup>[6]</sup> Finally, Order No. 901 notes that in the notice of proposed rulemaking that led to the order, FERC “proposed to direct NERC to develop new or modified Reliability Standards that would require registered IBR facilities to ride through system frequency and voltage disturbances where technologically feasible.”<sup>[7]</sup> FERC then adopted that very proposal,<sup>[C]8</sup> further demonstrating that FERC sought to direct NERC to only require frequency and voltage ride-through where technologically feasible.

When asked about this issue, FERC staff has indicated that as a general matter, when a Commission Order is silent on a topic it is neither requiring something nor requiring the absence of that thing. NERC is taking a contrary position by arguing that due to FERC’s silence they are not allowed to give an exemption for frequency ride-through.

NERC has been unable to present any technical reason why FERC would not allow a frequency ride-through exemption for existing IBRs, as none exists. Frequency ride-through has not been identified as a significant concern in any of the reports NERC has commissioned regarding IBR ride-through during disturbance events. Moreover, there is no technical justification for requiring existing IBRs to meet the extremely wide frequency ride-through bands proposed in PRC-029. PRC-029 requires IBRs to remain online for 6 seconds at 56-64 Hz, 5 minutes at 57-61.8, 11 minutes at 58.5-61.5, and indefinitely at 58.8-61.2 Hz. Under-Frequency Load Shedding (UFLS) that restores frequency following an extreme disturbance typically begins at 59.4 or 59.5 Hz. There is no credible reliability reason for requiring IBRs to remain online for 5 minutes for excursions that are 5 times more severe than the threshold at which UFLS restores frequency, and indefinitely for a frequency excursion twice as severe as that threshold. Such a requirement for IBRs is particularly pointless because PRC-024 would have allowed synchronous resources’ relays to trip those generators far before that point for far less severe excursions.

This highlights another likely reason FERC Order No. 901 did not explicitly direct NERC to include frequency ride-through exemptions: FERC did not anticipate that NERC would adopt such a strict frequency ride-through requirement that some existing IBR plants cannot meet it. The drafting team even notes at page 7 in the Technical Rationale document that “The proposed 6□second time frame of the frequency ride□through capability requirement is beyond the IEEE 2800 standard frequency ride□through requirement and beyond frequency ride□through requirements for synchronous machines under proposed PRC□024□4.” There is nothing in Order No. 901 that suggests that FERC was opposed to existing equipment exemptions for a frequency ride-through standard that was drafted after FERC issued Order No. 901 and is more stringent than FERC anticipated. A much more reasonable interpretation is that the logic FERC provided in paragraph 193 of Order No. 901 also applies to a frequency ride-through requirement that some existing resources cannot meet without physical modification or replacement of equipment. In fact, paragraph 193 makes clear that FERC’s language focuses on an exemption from voltage ride-through requirements because “a subset of existing registered IBRs... may be unable to implement the voltage ride though performance requirements directed herein.”

At the end of paragraph 193, FERC also explained that an exemption for existing resources would not harm reliability because “The concern that there are existing registered IBRs unable to meet voltage ride through requirements should diminish over time as legacy IBRs are replaced with or upgraded to newer IBR technology that does not require such accommodation.” FERC’s reasoning in paragraph 193 also applies to an exemption from frequency ride-through requirements, but particularly the conclusion that exempting existing plants does not cause reliability concerns and therefore should be allowed. The NERC drafting team’s technical justification document explicitly explains that the frequency ride-through requirement is “to ensure the reliability of future grids with high IBR penetration,”<sup>[C]9</sup> based on concerns about declining inertia due to IBRs replacing synchronous resources. NERC and others have demonstrated that inertia and frequency response will remain more than adequate for the foreseeable future even following disturbances that are several times larger than current credible contingencies, and that higher IBR penetrations can actually significantly improve frequency stabilization following disturbances.<sup>[10]</sup>

As a result, there is no reliability concern from an exemption for the small number of existing resources that cannot meet the requirements without physical modification or replacement of equipment. Moreover, as FERC notes, these plants will replace that equipment anyway over time as legacy



inverters fail or are replaced with more modern equipment for other reasons, and the draft standard requires replacement equipment to comply with the Standard. Utility-scale inverters installed at solar and battery installations typically come with warranties of 10 years or less, [C]11 and those inverters are typically replaced at least once during the plant's lifetime. Many existing wind plants are also being repowered with newer turbines, often to allow the project to receive another 10 years of production tax credits after the initial 10 years of credits have been received. As a result, by the time the drafting team's concerns about inertia in a high IBR penetration future might materialize, the vast majority of IBRs that cannot meet the frequency ride-through requirements will have been replaced with new equipment that is not exempt.

Moreover, the drafting team's assumption that frequency deviations will be larger on a future low inertia power system is flawed. IBRs can provide fast frequency response, which stabilizes frequency in the initial seconds following a grid disturbance, before synchronous generators begin to provide their slower primary frequency response. [12] Thus fast frequency response provides a similar service to inertia in helping to arrest the change in frequency before primary frequency response is fully deployed, reducing the need for inertia. [13] Fast frequency response is easily provided by batteries due to their available energy, but can also be provided by curtailed wind or solar resources. Power systems with high IBR penetrations will tend to have some wind or solar curtailment in a significant share of hours. If allowed to do so, solar and battery resources with spare DC capacity behind the inverter can also temporarily exceed their interconnection agreement's AC injection limit to provide fast frequency response.

The replacement of inflexible synchronous resources with more flexible IBRs could also significantly improve primary frequency response, as NERC's modeling has demonstrated. [C]14 NERC has also documented that only about 30% of synchronous generators provide primary frequency response, and only about 10% provide sustained primary frequency response. [15] Even with less inertia, the fast and accurate frequency response provided by IBRs will keep frequency more tightly controlled than the slow to nonexistent primary frequency response from synchronous generators. The replacement of large synchronous generators with smaller IBRs should also reduce the magnitude of frequency deviations following the loss of generators. If frequency response does begin to emerge as a concern, the more effective solution would be to enforce requirements on synchronous generators that are supposed to provide it but do not. If necessary, operators would alter real-time dispatch, as ERCOT and some island power systems occasionally do today, to ensure that inertia and fast frequency response are adequate to ensure under-frequency load shedding or generator tripping thresholds are not reached. Finally, grid-forming inverters are increasingly being deployed with battery storage and other IBR installations, further increasing the contributions of IBRs to stabilizing frequency.

At page 8 in the Technical Rationale document, the drafting team argues that "To compensate for the lack of inertia and short circuit contributions, [IBRs] should have wider tolerances for frequency and voltage excursions to meet the needs of future power systems with a higher percentage of IBR." The drafting team also argues that IBRs should have to ride-through much larger frequency deviations than synchronous resources because "Synchronous resources are more sensitive to frequency deviations than IBR resources." This logic is flawed for many reasons. Grid operators need all resources to ride through disturbances, and the contribution of a resource to inertia or short circuit needs is irrelevant to that need. Any concerns about resources' inertia and short circuit contributions are outside the drafting team's scope and authority, and should be addressed by other means (such as by increasing the deployment of grid-forming IBRs in the localized areas that have short circuit or stability concerns). It is also perverse for the drafting team to penalize IBRs for being less sensitive to frequency deviations than synchronous generators. As noted below, there are already grounds for FERC to reject this proposed standard due to undue discrimination against IBRs relative to the far more lenient requirements on synchronous generators under PRC-024, including an equipment limitation exemption for synchronous generators from the frequency relay setting requirement in PRC-024, [16] and this only adds to those concerns.

In short, the drafting team's unfounded concerns about a future power system do not justify withholding an exemption to frequency ride-through requirements for existing IBRs that will have been largely replaced by the time any concerns might materialize.

Finally, R4 equipment limitation exemptions should be allowed for resources with signed interconnection agreements as of the effective date of the Standard, instead of resources that are in-service as of that date. Resource equipment decisions are typically locked down at the time the interconnection agreement is signed, and a change in requirements after that point can require a costly change in equipment or settings that may also trigger a material modification and resulting interconnection restudies. The implementation plan for PRC-029 indicates that the effective date for the Standard will be the first day of the first quarter six months after FERC approval. Many resources take significantly longer than that to move from a signed interconnection agreement to being placed in service, so it makes more sense to allow R4 equipment limitation exemptions for resources that have a signed interconnection agreement as of the effective date of the Standard.

The current draft of the PRC-029 Standard is unworkable and will impose massive costs on some existing generators with no benefit for reliability. As explained above, the drafting team incorrectly ventures that "IBR should be capable of riding through the increased proposed 6-second frequency ride-through requirement without risk of equipment damage or need for frequency protection to operate," even after noting that some wind turbines use very different technology. NERC's rigorous standard development process exists to ensure that errors like this do not make it into final Standards, and the exceedingly low level of support for the initial draft and the major revisions in the current draft indicate that further revisions will likely be necessary. It takes time to fine tune highly technical requirements and vet them across the industry to avoid unnecessary and exorbitant costs for existing resources

that cannot meet the standard.

If PRC-29 continues to fall short of the level of support required for approval in this round of balloting, and NERC proceeds under Rules of Procedure Rule 321.2.1 by having the Standards Committee convene a technical conference and use the input from the technical conference to revise the standard for a final re-balloting period, incorporating an exemption from the frequency ride-through requirement for existing IBR generators would help to secure sufficient support for the standard to pass during re-balloting. Irreparable and immediate harm will occur if PRC-029 is allowed to move forward in its current form, harm that cannot be undone even if NERC immediately opens a standards revisions effort after the adoption of PRC-029 to fix these concerns. The current implementation plan requires BES IBRs to “ensure the design of their IBR units meets the criteria” within 12 months following regulatory approval of the standard, while for non-BES IBRs the compliance deadline will be the later of January 1, 2027, or 12 months following regulatory approval of the standard.<sup>[17]</sup> A year or two provides IBR owners with no time to wait if hundreds of GW of existing IBRs are required to secure retrofit or replacement equipment, find skilled technicians and tools to install that equipment, and complete that work during scheduled plant outages, especially since the entire industry will be pulling from the same pool of equipment and skilled labor. As a result, if PRC-029 is approved in its current form, IBR owners will immediately begin incurring massive non-refundable costs for equipment orders and labor contracts, as they cannot wait in the hope that a subsequent revision effort will fix this error. Moreover, the typical timeline from Standard Authorization Request through standard balloting and FERC approval is much more than a year, so industry would have no reason to expect such an effort could be completed before PRC-029 took effect.

### **Alternative solutions**

If NERC refuses to accept that Order 901 allows it to exempt existing IBRs from the frequency ride-through requirement, alternative solutions can mitigate the harm the proposed standard would cause. One alternative solution would be modifying the standard to allow IBRs, or at least existing IBRs, to meet far less stringent frequency ride-through curves than those proposed in PRC-029. The less stringent frequency ride-through curve or curves could be taken from PRC-024. As noted above, the PRC-024 curves are closer to but still significantly wider than UFLS thresholds, and thus are better tailored to meeting actual reliability needs. An additional advantage is that the PRC-024 curves have been in place for many years and thus many existing IBRs were designed with relays that would not trip them for disturbances of that magnitude. In contrast, the curves proposed in PRC-029 are far more stringent than past design practice and could not have been anticipated by IBRs when they were built. Industry could work to identify a reasonable and attainable frequency ride-through curve or curves at the technical conference that will likely be convened due to Rule 321.2.1, which could then be incorporated into the revised standard that subsequently goes out for a final re-balloting period.

This approach will not mitigate all of the harm caused by PRC-029, as PRC-024 still allows exemptions for equipment limitations,<sup>[18]</sup> while NERC is taking the position that PRC-029 cannot. Moreover, adopting something approximating the PRC-024 curves in PRC-029 would still result in disparate treatment for IBRs because PRC-024 is only a relay-setting standard and PRC-029 is a ride-through performance requirement. The most elegant solution, and the one least likely to result in a costly mistake that requires expensive retrofits and plant retirement for no reliability benefit, and risk FERC rejection of the standard, is to simply include an exemption for existing resources.

### **Undue discrimination**

Providing an exemption in PRC-029 R4 for existing IBRs that cannot meet the frequency ride-through requirement in R3 will provide less disparity with the treatment of synchronous resources under PRC-024, and is therefore an essential step if NERC wants to reduce the risk of FERC rejecting the proposed standard due to undue discrimination against IBRs. As noted above, PRC-024 allows exemptions for equipment limitations,<sup>[19]</sup> so exempting existing IBRs from PRC-029's frequency ride-through requirements would reduce the undue discrimination towards IBRs.

It should also be noted that PRC-029 is far more stringent because it is a ride-through performance requirement, while the existing and proposed versions of PRC-024 are simply relay-setting standards. PRC-024 only requires protective relays to be set so they do not trip the generator within specified bounds, but it allows a resource to trip offline for other reasons. PRC-024-4 explicitly allows a plant to trip if protection systems trip auxiliary plant equipment, per section 4.2.3. In contrast, PRC-029 is a performance standard that requires IBRs to remain electrically connected and to continue to exchange current within the specified voltage and frequency bounds. Said another way, an IBR and a synchronous resource could both trip during the same disturbance, and the IBR would be in violation of PRC-029 but the synchronous generator would not be in violation of PRC-024-4, as long as the synchronous generator did not trip due to the settings of its protection system.

To ensure grid reliability and resilience, all resources including IBRs and synchronous resources should ride through grid disturbances. The failure of synchronous generators to ride through grid disturbances threatens grid reliability as much or more than the failure of IBRs, as synchronous resources are often producing at a higher level of output, are more typically relied on as capacity resources, and often take longer to come back online and ramp up to full output if they trip due to a disturbance.

FERC Order No. 901 directed NERC to treat IBRs similarly to how NERC Standards treat synchronous generators, writing that the IBR Standard should “permit IBR tripping only to protect the IBR equipment in scenarios similar to when synchronous generation resources use tripping as protection from internal faults.”<sup>[C]20</sup> Allowing synchronous generators to trip but requiring IBRs to ride through the same or similar disturbance could be challenged at FERC as undue discrimination. Providing synchronous generators with an exemption from PRC-024’s frequency relay setting requirements but not offering IBRs an exemption from the far more stringent frequency ride-through requirements in PRC-029 only compounds the undue discrimination, and makes an even stronger case for FERC to reject PRC-029 as proposed.

Not requiring ride-through performance from synchronous generators is also at odds with the intent for this project that NERC stated in its February 2023 comments on the FERC proposed rulemaking that led to Order No. 901: “A comprehensive, performance-based ride-through standard is needed to assure future grid reliability. To that end, NERC re-scoped an existing project, Project 2020-02 Modifications to PRC-024 (Generator Ride-through), to revise or replace current Reliability Standard PRC-024- 3 with a standard that will require ride-through performance from all generating resources.”<sup>[21]</sup> FERC’s Order No. 901 also noted NERC’s statement that this project would require ride-through performance from all generating resources,<sup>[22]</sup> so a failure to require ride-through performance from synchronous generators is contrary to both NERC’s and FERC’s intent.

Providing an exemption in PRC-029 R4 for existing IBRs that cannot meet the frequency ride-through requirement in R3 will provide less disparity with the treatment of synchronous resources under PRC-024, and is therefore an essential step if NERC wants to reduce the risk of FERC rejecting the proposed standard due to undue discrimination against IBRs.

<sup>[C]1</sup> <https://www.utilitydive.com/news/clean-energy-capacity-wind-solar-2024-acp-report/715501/>

<sup>[C]2</sup> Technical Rationale, PRC-029-1 – Frequency and Voltage Ride-Through Requirements for Inverter-Based Generating Resources, at 8, [https://www.nerc.com/pa/Stand/202002\\_Transmissionconnected\\_Resources\\_DL/2020-02\\_PRC-029-1\\_Technical\\_Rationale\\_Redline\\_to\\_Last\\_Posted\\_06182024.pdf](https://www.nerc.com/pa/Stand/202002_Transmissionconnected_Resources_DL/2020-02_PRC-029-1_Technical_Rationale_Redline_to_Last_Posted_06182024.pdf) (“Technical Rationale”).

<sup>[C]3</sup> *Id.*, at 10

<sup>[C]4</sup> *Reliability Standards to Address Inverter-Based Resources*, Order No. 901, 185 FERC ¶ 61,042, P 193 (2023).

<sup>[C]5</sup> For example, **Section 215(d)(2) of the FPA** requires FERC to give “due weight” to the technical expertise of the ERO when evaluating the content of a proposed Reliability Standard or modification to a Standard.

**Order No. 733-A, P 11:** “In this order, we emphasize and affirm that we do not intend to prohibit NERC from exercising its technical expertise to develop a solution to an identified reliability concern that is equally effective and efficient as the one proposed in Order No. 733.”

**Order No. 748, P 43:** “In consideration of these ongoing efforts, we will not direct specific modifications to these Reliability Standards and, rather, accept NERC’s commitment to exercise its technical expertise to study these issues and develop appropriate revisions to applicable Standards as may be necessary.”

**Order No. 896, P 36:** “NERC may also consider other approaches that achieve the objectives outlined in this final rule. Further, as recommended by PJM, we believe there is value in engaging with national labs, RTOs, NOAA, and other agencies and organizations in developing benchmark events. Considering NERC’s key role, technical expertise, and experience assessing the reliability impacts of various events and conditions, we encourage NERC to engage with national labs, RTOs, NOAA, and other agencies and organizations as needed.”

**Order No. 901, P 192:** “We believe that, through its standard development process, NERC is best positioned, with input from stakeholders to determine specific IBRs performance requirements during ride through conditions, such as type (e.g., real current and/or reactive current) and magnitude of current. NERC should use its discretion to determine the appropriate technical requirements needed to ensure frequency and voltage ride through by registered IBRs during its standards development process.”

<sup>[C]6</sup> Order 901, P 193

<sup>[C]7</sup> *Id.* at P 178.

<sup>[C]8</sup> *Id.* at P 190.



[\[C\]9\[C\]](#) Technical Rationale at 7.

[\[C\]10\[C\]](#) East Interconnection Frequency Response Assessment with Inverter Based Resources, at 7  
<https://www.energy.gov/sites/prod/files/2018/07/f53/2.1.4%20Frequency%20Response%20Panel%20-%20Velummylum%2C%20NERC.pdf>.

[\[C\]11\[C\]](#) Best Practices for Operation and Maintenance of Photovoltaic and Energy Storage Systems, at 55,  
<https://www.nrel.gov/docs/fy19osti/73822.pdf>.

[\[C\]12\[C\]](#) Fast Frequency Response Concepts and Bulk Power System Reliability Needs, [https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20RPT/Fast\\_Frequency\\_Response\\_Concepts\\_and\\_BPS\\_Reliability\\_Needs\\_White\\_Paper.pdf](https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20RPT/Fast_Frequency_Response_Concepts_and_BPS_Reliability_Needs_White_Paper.pdf).

[\[C\]13\[C\]](#) Inertia and the Power Grid: A Guide Without the Spin, <https://www.nrel.gov/docs/fy20osti/73856.pdf>.

[\[C\]14\[C\]](#) East Interconnection Frequency Response Assessment with Inverter Based Resources, at 7  
<https://www.energy.gov/sites/prod/files/2018/07/f53/2.1.4%20Frequency%20Response%20Panel%20-%20Velummylum%2C%20NERC.pdf>.

[\[C\]15\[C\]](#) [https://www.nerc.com/pa/Stand/Project%20200712%20Frequency%20Response%20DL/FRI\\_Report\\_10-30-12\\_Master\\_w-appendices.pdf](https://www.nerc.com/pa/Stand/Project%20200712%20Frequency%20Response%20DL/FRI_Report_10-30-12_Master_w-appendices.pdf)

[\[C\]16\[C\]](#) [https://www.nerc.com/pa/Stand/202002\\_Transmissionconnected\\_Resources\\_DL/2020-02\\_PRC-024-4\\_Draft\\_2\\_Clean\\_06182024.pdf](https://www.nerc.com/pa/Stand/202002_Transmissionconnected_Resources_DL/2020-02_PRC-024-4_Draft_2_Clean_06182024.pdf), R3, at pages 5-6

[\[C\]17\[C\]](#) [https://www.nerc.com/pa/Stand/202002\\_Transmissionconnected\\_Resources\\_DL/2020-02\\_PRC-024-4\\_PRC-029-1\\_Implementation%20Plan\\_Redline\\_to\\_Last\\_Posted\\_07222024.pdf](https://www.nerc.com/pa/Stand/202002_Transmissionconnected_Resources_DL/2020-02_PRC-024-4_PRC-029-1_Implementation%20Plan_Redline_to_Last_Posted_07222024.pdf)

[\[C\]18\[C\]](#) [https://www.nerc.com/pa/Stand/202002\\_Transmissionconnected\\_Resources\\_DL/2020-02\\_PRC-024-4\\_Draft\\_2\\_Clean\\_06182024.pdf](https://www.nerc.com/pa/Stand/202002_Transmissionconnected_Resources_DL/2020-02_PRC-024-4_Draft_2_Clean_06182024.pdf), R3, at pages 5-6

[\[C\]19\[C\]](#) [https://www.nerc.com/pa/Stand/202002\\_Transmissionconnected\\_Resources\\_DL/2020-02\\_PRC-024-4\\_Draft\\_2\\_Clean\\_06182024.pdf](https://www.nerc.com/pa/Stand/202002_Transmissionconnected_Resources_DL/2020-02_PRC-024-4_Draft_2_Clean_06182024.pdf), R3, at pages 5-6

[\[C\]20\[C\]](#) Order No. 901, at P190

[\[21\]\[C\]](#) [https://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/Comments\\_IBR%20Standards%20NOPR.pdf](https://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/Comments_IBR%20Standards%20NOPR.pdf), at 21-22.

[\[22\]\[C\]](#) Order No. 901, at P185

Likes 0

Dislikes 0

## Response

**Brian Van Gheem - Radian Generation - NA - Not Applicable - NA - Not Applicable**

Answer

No

Document Name

Comment

1. Requirements R1, R2 and R3 use the phrase “ensure design and operation” to imply a Generator Owner is required to guarantee an IBR will be operated in Real-time as designed. We observe the Standard Drafting Team’s (SDT) previous response to the meaning of this phrase is clarified through the “additional specificity and examples for objectively evaluating compliance” within each requirement’s measure. We believe this is outside the scope of the NERC Protection and Control Reliability Standards, as only a Generator Operator can make such guarantees. The scope of the Protection and Control Reliability Standards are to ensure facility equipment is properly configured and with settings that achieved

sufficient reliability during facility operating simulations. Several of these Reliability Standards have periodicities that ensure the initial design philosophy is still being achieved through repeatable simulations, even years after a facility's commissioning date. The purpose of NERC Reliability Standard PRC-005-6 is to ensure a facility's Protection Systems, particularly relays, are maintained within their intended design settings. We believe the phrase proposed by the SDT should be clarified to imply designed to operate under simulated conditions and disturbances. For Requirement R1, we propose this clarification for consideration, "Each Generator Owner shall ensure each IBR is designed, both initially and following the IBR's commissioning, to meet or exceed the Ride-through requirements in accordance with the Continuous Operation Region specified in Attachment 1."

2. We believe the possibility of an IBR limitation should not be limited to hardware. In the past, such limitations may have been imposed on Generator Owners because some equipment manufacturers were unable to achieve functional requirements through firmware modifications. Moreover, some equipment manufacturers terminated their business operations entirely. We believe the SDT should broaden each reference within the Reliability Standard and omit any descriptive adjectives associated with a limitation.
3. Part 2.1.3 states during a voltage excursion, each Generator Owner shall ensure the design of its IBR is set to prioritize Real Power or Reactive Power, unless overridden by another registered entity, when the voltage at the high side of the main power transformer is less than 0.95 per unit, yet still within the continuous operation region as specified in Attachment 1, and the IBR cannot deliver both Real Power and Reactive Power. We believe the SDT could simplify this language, as the Generator Owner will not have enough information of the Bulk Power System to make an informed decision on the appropriate priority during anticipated system conditions and configurations in the future. We believe the SDT should instead clarify the default priority for Generator Owners is Reactive Power, like Part 2.2.
4. Under Requirement R3, each Generator Owner is required to ensure its IBRs meet or exceed the Ride-through requirements during a frequency excursion event whereby the absolute rate of change of frequency (RoCoF) magnitude is less than or equal to 5 Hz/second. This requirement assumes the configurable function is enabled. We recommend the SDT clarify the absolute rate of change of frequency (RoCoF) magnitude requirement is set only when such a function is enabled.
5. To summarize Requirement R4, any limitations identifying an IBR is unable to meet the voltage Ride-through criteria detailed in Requirements R1 and R2 must be documented. Under the individual parts of this requirement, there is no option available for a Generator Owner to have a limitation indefinitely applied. We also believe Parts 4.1.4 and 4.1.5 require supporting technical documentation and plans to correct a limitation as possible language that should be incorporated in the requirement's measure.
6. We believe the SDT should modify the language of each measure for Requirements R1, R2, and R3. The phrase "but are not limited to" should be removed within each measure. The possible evidence identified should not imply that each example is needed. We also recommend replacing the "and" within the items of a series with an "or."
7. As defined within Section 2.5 of Appendix 3A (Standard Processes Manual) of the NERC Rules of Procedure, a Measure "provides identification of the evidence or types of evidence that may demonstrate compliance with the associated requirement." We believe the reference to "shall" within each measure of a requirement of this proposed Reliability Standard is misaligned with the NERC Rules of Procedure. For instance, as proposed, each Generator Owner is required to retain evidence of actual disturbance monitoring (i.e. Sequence of Event Recorder, Dynamic Disturbance Recorder, and Fault Recorder) data to demonstrate the operation of each IBR did adhere to Ride-through requirements. Such data may not be available because of equipment failures that are then handled through compliance with other Reliability Standards. Entities also need to implement their own internal processes to extract this data before a limited storage capacity overrides this historical information. We believe the Standard Drafting Team should instead focus on identifying evidence that may demonstrate compliance, such as an ongoing design philosophy that each IBR will meet the Ride-through requirements in accordance with the Continuous Operation Regions specified within the Reliability Standard's attachments.
8. We believe a significant burden has been placed on Generator Owners with the expectation listed within Measure M2 that the Generator Owner will retain, for each voltage excursion, actual disturbance monitoring (i.e. Sequence of Event Recorder, Dynamic Disturbance Recorder, and Fault Recorder) data to demonstrate that the operation of each IBR did adhere to this Reliability Standard's performance requirements. It should be noted that other proposed Reliability Standards are placing limitations on which voltage excursions are applicable for analysis. A similar burden is listed within Measure M3 with each frequency excursion. We recommend the SDT remove this burden entirely. Instead, we propose offering a Generator Owner an opportunity to provide their IBR's equipment settings for the period prior to the facility's commissioning and actual disturbance monitoring (i.e. Sequence of Event Recorder, Dynamic Disturbance Recorder, and Fault Recorder) data at the Generator Owner's discretion. If the Generator Owner needs to demonstrate their facility's performance following a Disturbance, the actual disturbance monitoring data will be requested under Reliability Standard PRC-030-1. Moreover, such a request should originate from an external reliability entity and not require the Generator Owner to collect actual disturbance monitoring data following each voltage or frequency excursion.
9. We believe the mathematical symbol associated the 1.10 per unit voltage range listed in Attachment 1, Table 2, should be greater than and equal to" instead of just "greater than."

Likes 0

Dislikes 0

**Response**

**Robert Follini - Avista - Avista Corporation - 3**

**Answer** No

**Document Name**

**Comment**

See EEi comments

Likes 0

Dislikes 0

**Response**

**Patricia Lynch - NRG - NRG Energy, Inc. - 5**

**Answer** No

**Document Name**

**Comment**

NRG Energy Inc is in support of the comments made by EPSA.

Likes 0

Dislikes 0

**Response**

**Andy Thomas - Duke Energy - 1,3,5,6 - SERC,RF**

**Answer** No

**Document Name**

**Comment**

(A) Duke Energy agrees with and supports EEI R4 comments for the three reasons cited by EEI because it is unclear how many existing resources can meet the frequency performance standards mandated in Requirement 3 and resource owners have not been given adequate time to fully assess the impact of imposing these new requirements on their existing resources,

(B) Duke Energy disagrees with the language in Measures 1-3 and recommends alternative language as stated below:

Measures 1-3 generally states:

“Each Generator Owner shall retain evidence of actual disturbance monitoring (i.e. Sequence of Event Recorder, Dynamic Disturbance Recorder, and Fault Recorder) data to demonstrate the operation of each facility IBR did adhere to Ride-through requirements,” as specified in Requirement 1/2/3.

This statement requires heavy administrative burden and data storage since it would require capturing data daily and downloading the data to a storage location separate from the DDR,FR, & SER; since this equipment has low memory thresholds, memory could be exceeded. Accordingly, the TO/TOP would be required to notify the GO of a grid frequency event and data could be overwritten prior to TO/TOP notification.

Recommendation:

Each Generator Owner shall retain evidence of actual disturbance monitoring (i.e. Sequence of Event Recorder, Dynamic Disturbance Recorder, and Fault Recorder) data, “upon notification for TO/TOP” to demonstrate the operation of each facility IBR did adhere to Ride-through requirements “or notification of data overwrite to TO/TOP.”

(C) Measure 1, 2 and 3 language is not consistent (suggested corrections added below):

- The word data was eliminated from M1: ...Fault Recorder) “data” to demonstrate...
- The word ride-through was eliminated from M2: ...IBR will adhere to “Ride-through” requirements, as specified in Requirement...
- Did the SDT intentionally substitute “performance” for “Ride-through requirements” in M2 – see second sentence excerpt below?  
...each IBR did adhere to “Ride-through requirements”, as specified in Requirement...

Likes 0

Dislikes 0

### Response

**Jessica Cordero - Unisource - Tucson Electric Power Co. - 1**

**Answer**

No

**Document Name**

**Comment**

TEPC agrees with EEI's comments regarding PRC-029-1, requirement 4. EEI does not agree with imposing new unverified requirements on existing resources as proposed in PRC-029-1 because it is unclear how many existing resources can meet the frequency performance standards mandated in Requirement 3. We are additionally concerned because resource owners have not been given adequate time to fully assess the impact of imposing these new requirements on their existing resources, which align with IEEE 2800-2022 (See 7.3.2.1 Figure 12 & Table 15 (Frequency ride-through, page 80; and see 7.3.2.3.5 Rate of change of frequency (ROCOF), page 82), and did not exist as a Standard until February 2022, after most of these resources were built or placed in service. For this reason, we cannot support the approval of PRC-029-1 without the following changes to Requirement 4 ensure that existing resources that were not design and do not have the capability to meet these requirements are allowed to declare an exemption for frequency ride-through similar to what is provided for resources that cannot meet the voltage ride-through requirements.

Likes 0

Dislikes 0

**Response**

**Marcus Bortman - APS - Arizona Public Service Co. - 6**

**Answer**

No

**Document Name**

**Comment**

AZPS Supports the following comments that were submitted by EEI on behalf of its members:

EEI does not agree with imposing new unverified requirements on existing resources as proposed in PRC-029-1 because it is unclear how many existing resources can meet the frequency performance standards mandated in Requirement 3. We are additionally concerned because resource owners have not been given adequate time to fully assess the impact of imposing these new requirements on their existing resources, which align with IEEE 2800-2022 (See 7.3.2.1 Figure 12 & Table 15 (Frequency ride-through, page 80; and see 7.3.2.3.5 Rate of change of frequency (ROCOF), page 82), and did not exist as a Standard until February 2022, after most of these resources were built or placed in service. For this reason, we cannot support the approval of PRC-029-1 without the following changes to Requirement 4 ensure that existing resources that were not design and do not have the capability to meet these requirements are allowed to declare an exemption for frequency ride-through similar to what is provided for resources that cannot meet the voltage ride-through requirements. See the proposed changes to R4 below:

**R4.** Each Generator Owner identifying an IBR that is in-service by the effective date of PRC-029-1, has known hardware limitations that prevent the IBR from meeting voltage and frequency Ride-through criteria as detailed in Requirements R1, R2, and R3 and requires an exemption from specific Ride-through criteria shall:

**4.1.** Document information supporting the identified hardware limitation no later than 12 months following the effective date of PRC-029-1. This documentation shall include:

**4.1.1** Identifying information of the IBR (name and facility #);

**4.1.2** Which aspects of voltage or frequency Ride-through requirements that the IBR would be unable to meet and the capability of the hardware due to the limitation;

**4.1.3** Identify the specific piece(s) of hardware causing the limitation;

**4.1.4** Supporting technical documentation verifying the limitation is due to hardware that needs to be physically replaced or that the limitation cannot be removed by software updates or setting changes, and;

**4.1.5** Information regarding any plans to remedy the hardware limitation (such as an estimated date).

**4.2.** Provide a copy of the information detailed in Requirement R4.1 to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), Reliability Coordinator(s), and the CEA no later than 12 months following the effective date of PRC-029-1.

**4.2.1** Any response to additional information requested by the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), Reliability Coordinator(s), and the CEA shall be provided back to the requestor within 90 days of the request.

**4.2.2** Provide a copy of the acceptance of a hardware limitation by the CEA to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s).[11](#)

**4.3.** Each Generator Owner with a previously accepted limitation that replace the hardware causing the limitation shall document and communicate such a hardware change to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s) within 90 days of the hardware change.

**4.3.1** When existing hardware causing the limitation is replaced, the exemption for that Ride-through criteria no longer applies.

Likes 0

Dislikes 0

**Response**

**Sean Bodkin - Dominion - Dominion Resources, Inc. - 6, Group Name** Dominion

**Answer**

No

<b>Document Name</b>	
<b>Comment</b>	
Dominion Energy supports EEI comments. Current technology does not appear to support being able to fulfill these requirements on a go forward basis.	
Likes 0	
Dislikes 0	
<b>Response</b>	
<b>Donna Wood - Tri-State G and T Association, Inc. - 1</b>	
<b>Answer</b>	No
<b>Document Name</b>	
<b>Comment</b>	
Please see additional comments in Question #3.	
Likes 0	
Dislikes 0	
<b>Response</b>	
<b>Rachel Schuldt - Black Hills Corporation - 6, Group Name Black Hills Corporation - All Segments</b>	
<b>Answer</b>	No
<b>Document Name</b>	
<b>Comment</b>	
<p>Black Hills Corporation supports the comments provided by the NAGF which state: "...recommends that PRC-029 be revised to allow for frequency ride through ("FRT") exemptions to address such limitations for legacy IBR facilities. Not including FRT exemptions will result in a standard that will make certain IBR legacy facilities automatically non-compliant when the standards becomes effective.</p> <p>Requirement R3 – the NAGF is concerned that legacy IBR facilities are not capable of meeting the 5 Hz/second maximum ROCOF or the 25-degree phase angle jump requirements. Therefore, FRT exemptions are necessary and need to be included in Requirement R3.</p> <p>Requirement R4.2.2 – the NAGF is unclear as to what the Compliance Enforcement Authority (CEA) acceptance for a IBR hardware limitation exemption will consist of. Will the CEA provide an email response confirming acceptance to the Generator Owner submitting the exemption? How are such exemptions to be submitted and to whom within the CEA organization?</p>	
Likes 0	
Dislikes 0	
<b>Response</b>	

**David Vickers - David Vickers On Behalf of: Daniel Roethemeyer, Vistra Energy, 5; - David Vickers**

**Answer** No

**Document Name**

**Comment**

Vistra supports comments made by AEP (Fultz)

Likes 0

Dislikes 0

**Response**

**Jennifer Weber - Tennessee Valley Authority - 1,3,5,6 - SERC**

**Answer** No

**Document Name**

**Comment**

1. Requirement 2.1.3/2.2/2.5 - What does "other mechanisms" mean? Too vague.
2. Requirement 4.1.1 - change "facility #" to "facility unique identification number."
3. Requirement 4.2 - "CEA" is not defined in first instance of the acronym in the document.
4. Multiple Requirements list several points of contact for notification ("associated" PC, TP, TO, RC, CEA). This seems like a very long list of contacts that would likely lead to unnecessary PNCIs. Can this list be reduced?

Likes 0

Dislikes 0

**Response**

**Mark Garza - FirstEnergy - FirstEnergy Corporation - 4, Group Name FE Voter**

**Answer** No

**Document Name**

**Comment**



FirstEnergy does not agree with the current draft(3) of PRC-029-1.

FirstEnergy continues to request the DT consider changing PRC-029-1 Requirement R2, part 2.5, from 'Real Power' to 'Apparent Power'. To satisfy R2.5 as written, IBR sites would need to operate in static VAR control rather than automatic voltage control (adjusting VARs to control voltage). This would maintain a static power factor on the sites that would fail to provide effective voltage support due to manual intervention required to adjust VAR setpoint, not allowing for immediate response to voltage changes. This weakened response to voltage changes could result in less stable grid voltage, increasing potential for voltage trips, which does not align with the intent of the Standard. Changing this to 'Apparent Power' would make compliance more achievable while improving voltage support from IBR generators, enhancing IBR stability and reliability.

FirstEnergy also does not agree with the concept of 'Available Real Power' as used in R2.1.1 & R2.5 and defined in in footnotes 4 & 7 of Standard draft 3. Terminology/concepts critical for determining or maintaining compliance should be clearly defined in the NERC Glossary of Terms, not nested in a Standard footnote. For this term, specifically as it pertains to solar installations, the methods for measuring and approximating the 'Available' irradiance should be defined in detail as a Standard Attachment or preferably a Reliability Guideline. This guidance is required to create design specifications and ensure Owners/Operators consistently and uniformly quantify this resource for a given time and physical location. However, even with well-defined methods provided, it seems the ability of an Owner/Operator to definitively prove an exception in the case of solar would be challenging and difficult to audit; examples of evidence needed to properly justify an exception should be provided as guidance as well.

FirstEnergy also believes there could be a conflict between VAR-002 and PRC-029 for those IBR Resources meeting the applicability criteria of both Standards. VAR-002 requires generators to operate in automatic voltage control mode, adjusting reactive power output to control voltage. Adherence to PRC-029 R2.5 seems to directly conflict. This would require having alternative instructions from the TP/PC/RC/TOP, essentially granting an exception to one of the two Standards, to avoid a situation of non-compliance. Further clarification from the DT is warranted addressing the overlap/conflict between the two Standards and how an applicable IBR generator is to comply to both.

Likes 0

Dislikes 0

### Response

### Bruce Walkup - Arkansas Electric Cooperative Corporation - 6

Answer

No

Document Name

Comment

1. "Removing Transmission Owners (TOs) from the applicability section places all accountability during voltage and frequency excursions on the IBR's Generator Owner (GO) regardless of the initial incident that starts the voltage or frequency excursion and regardless of who owns any impacted connecting equipment. This creates an inconsistency in compliance between PRC-024-4 and PRC-029-1."

2. "The new wording in Section 2.1.3 is unclear."

3. "Sections 2.1 and 2.2 are worded in a way that seems conflicting."

Likes 0

Dislikes 0

### Response

**Thomas Foltz - AEP - 5****Answer**

No

**Document Name****Comment**

R1, R2 and R3 state, “Each Generator Owner shall ensure the design and operation is such...” Operation of the equipment is the GOP’s responsibility, not the GO’s. If the SDT’s intention was regarding the design of the system, AEP recommends revising the language to instead state, “Each Generator Owner shall ensure the \*operational design\* is such...”.

AEP recommends removing the phrase “demonstrate the design of each facility” from the proposed standard and returning to the original event-based requirements. The phrase may prove difficult to fully comply with, as a Functional Entity would have to know the design of the collector system and parameters and run the models correctly to demonstrate this. Much of this needed information would need to be provided by the manufacturer, which may require non-disclosure agreements.

There needs to be an exemption for system-related causes of ride-through failure. IBRs should be exempt from ride-through requirements in R1 through R3 if tripping or failure to ride through is attributable to any of the following:

1. Sub-synchronous control interaction or ferro-resonance involving series compensation confirmed by the TOP, RC, TP, or PC
2. Unstable behavior of other nearby IBRs or dynamic devices such as FACTS or HVDC confirmed by the TOP, RC, TP, or PC
3. System short circuit levels during contingencies below the level of IBR stable operation confirmed by the TOP, RC, TP, or PC
4. System-level transient or oscillatory instabilities confirmed by the TOP, RC, TP, or PC

AEP is concerned by the inclusion of the phrase “other mechanisms” in this standard, and recommend it be removed from Requirements 2.1.3, 2.2, and 2.5 as we believe it could be misinterpreted or misunderstood.

AEP believes the text “any response to additional information requested” in R 4.2.1 is confusing and should be clarified. AEP suggests it instead state “Additional information requested by the associated...”. In addition, Compliance Enforcement Authority should be spelled out in its entirety in its first use in the standard.

R4.2.2 states an obligation to “Provide a copy of the acceptance of a hardware limitation by the CEA to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s).” AEP recommends that insight be provided in the Technical Rationale as to how the SDT envisions this acceptance process, and the timing thereof, would work.

Likes 0

Dislikes 0

**Response****Brian Lindsey - Entergy - 1****Answer**

No

**Document Name****Comment**

M1: This seems more like a requirement than a measure for meeting the requirement.

R2, M2, M3 and R4: Duplicative of Mod-026 and MOD-027. Also, seems to be dependent on PRC-028 passing and sites having DDRs installed.

R2 is not clear. It seems to overlap significantly with VAR-002.

R2.5 While the IBRs can respond quicker than 1 second and should be able to restore active power to the pre-disturbance level within that time-frame it may be difficult to have enough historian capability to ensure proper evidence.

R3 No provisions for exemptions for frequency limitations.

R4.1 thru 4.2: Are we seeking approval from this large list of entities for an exemption or are we documenting the limitation that prevents from meeting requirement 1? If we have to get approval there is no requirement in this standard that require any of these entities to provide that approval.

Recommend limiting who must be notified to just the TP or TP and RC. There needs to be a single point of contact instead multiple entities.

The CEA should not play a role in the acceptance or denial of limitations. Standards Drafting Teams have no authority to create requirements that the CEA must adhere to therefore, there are no penalties to the CEA if they do not provide an acceptance.

Likes 0

Dislikes 0

### Response

**Ayslynn Mcavoy - Arkansas Electric Cooperative Corporation - 3**

**Answer**

No

**Document Name**

**Comment**

SMEs responded with the following comments:

1. "Removing Transmission Owners (TOs) from the applicability section places all accountability during voltage and frequency excursions on the IBR's Generator Owner (GO) regardless of the initial incident that starts the voltage or frequency excursion and regardless of who owns any impacted connecting equipment. This creates an inconsistency in compliance between PRC-024-4 and PRC-029-1."
2. "The new wording in Section 2.1.3 is unclear."
3. "Sections 2.1 and 2.2 are worded in a way that seems conflicting."

Likes 0

Dislikes 0

**Response**

**Kennedy Meier - Electric Reliability Council of Texas, Inc. - 2**

**Answer** Yes

**Document Name**

**Comment**

ERCOT joins the comments submitted by the IRC SRC and adopts them as its own.

Likes 0

Dislikes 0

**Response**

**Steven Rueckert - Western Electricity Coordinating Council - 10, Group Name WECC**

**Answer** Yes

**Document Name**

**Comment**

The DT should consider emphasizing the nature of the definition may not allow a single turbine or solar array to be lost in a System Disturbance (equates to failed "Ride-through" with loss).

Likes 0

Dislikes 0

**Response**

**Charles Yeung - Southwest Power Pool, Inc. (RTO) - 2 - MRO,WECC,Texas RE,NPCC,SERC,RF, Group Name SRC 2024**

**Answer** Yes

**Document Name**

**Comment**

The SRC supports the addition of Part 4.2.2.:

4.2.2 Provide a copy of the acceptance of an hardware limitation by the CEA to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s).

Likes 0

Dislikes 0

## Response

Jens Boemer - Electric Power Research Institute - NA - Not Applicable - NA - Not Applicable

Answer

Yes

Document Name

Comment

The work and efforts of this standard drafting team are much appreciated. Thank you for considering EPRI comments on the previous drafts as submitted previously. The new Draft 3 appears to be improved regarding internal consistency and alignment with requirements specified in voluntary industry standards, for example, IEEE 2800-2022. However, further improvements and alignment could be considered as follows:

### A. General comments:

- Aligned with the directives to NERC in FERC order 901, the draft PRC-029 standard and the Implementation Plan for Project 2020-02 propose that the requirements apply to all applicable IBRs upon the standard's revised effective date or the newly added phased-in compliance dates. Applicable IBRs include existing (Legacy) IBRs that are already in operation prior to the specified dates. Requirement R4 provides a path for each Generator Owner to request a limited and documented exemption of a legacy IBR from the voltage ride-through criteria specified in R1 and R2. According to the Implementation Plan of Project 2020-02, "[o]ther NERC Standards Development projects will be pursued to address ongoing identification and mitigation of any potential reliability impacts to the BPS for such exemptions." A similar exemption from Requirement R3 that specifies applicable IBR frequency ride-through criteria is not possible according to the draft standard.
  - The proposed approach may require documentation of hardware limitations or reconfiguration for a significant number of legacy IBRs across North America. Neither the draft Technical Rationale nor the FERC record under RM22-12 present or cite sufficient technical evidence that supports this broad application of the proposed standard to existing IBRs in all applicable NERC regions.
  - International experience has shown that documentation of hardware limitations to support exemption from, or the retroactive application of similarly stringent ride-through capability requirements on legacy IBRs are associated with significant uncertainties, potential technical and procedural challenges, and costs. Justification of similarly ambitious regulations enforced in other countries required the production of evidence like post-mortem disturbance analysis or case studies that *quantified* the potential impact of non-compliant existing IBRs on the bulk power system stability and reliability.[1],[2]
  - Consequently, stakeholder concerns contribute to low approval rates for the draft PRC-029, possibly causing delays in moving the draft standard through the NERC process toward timely and effective enforcement for at least all new IBRs. Considering the approx. 2,600 GW of new IBRs in the interconnection queues across North America[3], these delays bear potentially significant risk for the BPS.
  - Furthermore, the proposed revised effective date and newly added phased-in compliance date of the capability-based elements of Requirements R1, R2, and R3 as specified in the draft PRC-029 are different from the transition periods found in international practice of similarly ambitious rule changes for new and IBRs (see the comments on Implementation Plan below for further details).
- The term Inverter-based Resource (IBR) to which the draft standard is intended to apply refers to proposed definitions being developed under the Project 2020-06 Verifications of Models and Data for Generators. Although the new draft includes redlines that strike the explicit mentioning of VSC-HVDC transmission facilities that are dedicated connections for IBR to the BPS, the definition proposed by Project 2020-06 is sufficiently broad that it could cover such facilities. For further clarity on the scope and application of the proposed PRC-029 standard, it could be helpful to add a clarifying sentence or to copy parts of Footnote 2 that clarifies the location of the "main power transformer" in case of IBR connecting via a dedicated VSC-HVDC transmission facility into the terms section on page 2 of the standard.
- For the purpose of clarity, harmonization, and compliance of IBR across North America, proposed requirements could even further align with requirements that are testable and verifiable as specified in voluntary industry standards developed through an open process such as ANSI, CIGRE, IEC, or IEEE. The drafting team is encouraged to review these standards and where applicable further align, for example:
  - Requirement R1 and R2 relate to IEEE Std 2800™-2022, Clause 7.2.2 (Voltage disturbance ride-through requirements), with consideration of Clause 7.3.2.4 (Voltage phase angle changes ride-through) as a stated exception in R1.
  - Requirement R3 relates to IEEE Std 2800™-2022, Clause 7.3.2 (Frequency disturbance ride-through requirements), with consideration of Clause 7.3.2.3.5 (Rate of change of frequency (ROCOF) ride-through) as a stated exception in R3.
  - Measures M1–M3 relate to IEEE P2800.2 Draft 1.0a, Clause 5 (Type tests), Clause 6 (Validation procedures for IBR unit models and

- supplemental IBR device models), and Clause 7 (Design evaluations), Clause 8 (As-built installation evaluations), Clause 9 (Commissioning tests), Clause 10 (Post commission model validation), and Clause 11 (Post-commissioning monitoring).
- Measure M4, additionally, relates to IEEE P2800.2 Draft 1.0a, Clause 12 (Periodic tests), and Clause 13 (Periodic verification).
- The draft standard does not specify grid conditions for which the specified ride-through requirements apply. During its lifetime, a plant may experience many different operational conditions, along with changes to the grid, and may fail to ride-through an event if the plant was operating in a grid condition vastly different from that which it was designed for. The standard could include an exception for such situations based on leading industry practices, or a requirement for the TP, PC, etc. to specify such an exception.
- IEEE 2800-2022 allows for an exception for “self-protection” when negative-sequence voltage is greater than specified duration and threshold within continuous operation region. There is no such exception in draft PRC-029. Such an exception may be necessary for type III wind turbine generator (WTG) based plants.
- Standard does not allow any flexibility for failure of ride-through resulting from misoperation of protection system. The misoperation of protection system may occur for many reasons over the life of a plant. For example, for a fault on a transmission system, if differential protection for the main step-up transformer misoperates due to environmental issues such as damage due to water from a leaking roof or animal intrusion, then plant would be considered out of compliance. If a synchronous machine based generating plant trips because of similar issue, it would not be out of compliance with PRC-024.
- Requirements R1–R4 call out both “design and operation”. If the plant is designed to ride-through, then is it necessary to specifically call out and include IBR “operation” into the scope of PRC-029?
  - The inclusion of “operation” in PRC-029 would put a Generator Owner out of compliance with the standard whenever one of their IBR plants fails to ride-through real world disturbances, including incidents where failure of ride-through within the specified abnormal voltage and frequency conditions was beyond the GO’s control.
  - An alternative approach could be to narrow the scope of PRC-029 to require a Generator Owner to adequately *design* each IBR *to have the capability* to ride-through the specified abnormal conditions. The GO could then be further required by PRC-028 and PRC-030 to monitor IBR performance during operations and for real world events. If an IBR was found to have failed ride-through during operations, then PRC-030 could require the GO to identify the underlying issues and to take corrective action.

#### B. Ride-through definition

- Consider adopting definition from IEEE 2800, which is from IEEE 1547, and well understood by the industry.

#### C. Requirement R1:

- Requirement calls out “design and operation”. If the plant is designed to ride-through then is it necessary to specifically call out “operation”?
  - The Reliability Standard PRC-006, Requirement R3, requires PC to develop UFLS program. Several assumptions are made here. If an event occurs, then R11 requires assessment of an event and if deficiency in UFLS program is identified then PC is required to consider deficiencies in R12. If UFLS program was deficient then PC is not out of compliance with R3 (or any other requirements in the standard). This is a good-faith approach: Design UFLS program and if actual event shows deficiency in UFLS Program then fix it. No compliance issues, as far as UFLS program was designed per Requirement R3.
  - Same approach could be taken in PRC-029, where R1 could require that plant is designed to ride-through specified voltage disturbance. The PRC-028 and PRC-030 then requires monitoring of plant performance and take corrective actions when necessary.
  - The same approach could be extended to requirements R2 and R3.
- If IBR operation remains within the scope of PRC-029, then consider revising the beginning of the sentence as following for better readability: *Each Generator Owner shall design and operate each IBR to meet or exceed Ride-through requirements...*
  - The same changes could be extended to requirements R2 and R3.

#### D. Requirement R2

- Refer to comments on R1 that could be extended to requirement R2.

#### E. Requirement R2, Part 2.1

- Why is it necessary to specify a performance requirement when voltage is in the continuous operation region? The standard remains silent on performance expectation for frequency ride-through requirements. For performance requirement for voltage ride-through mandatory operation region is also very brief. The intent of this standard is to focus on ride-through during voltage and frequency disturbances. If there is a desire to address performance then one option could be to simply state that performance shall be as specified by TP, PC, etc. That is in Part 2.1.3 anyway.
- Part 2.1.2: remove “and according to its controller settings”. It is not incorrect but “according to its controller settings” inherently apply to all performance requirements.
- Part 2.1.3: this requirement in IEEE 2800 was necessary and was tied to reactive power capability requirement as shown in Figure 8 of IEEE 2800. Given PRC-029 does not include reactive power capability requirements, perhaps PRC-029 could remain silent.

#### F. Requirement R2, Part 2.2

- Part 2.2 applies at the high-side of the main power transformer. The IBR is required to exchange current, up to the maximum capability. How is the “maximum capability” of an IBR determined? There could be some explanation, perhaps with examples, in the technical rationale document.
- The phrase “provide voltage support on affected phases during both symmetrical and unsymmetrical voltage disturbances” is confusing.
  - It is understood that intent is to require to inject “unbalanced current” or “negative-sequence” current during asymmetrical faults. However, as written, injection of balanced reactive current into an unbalanced fault meets the requirement to provide voltage support on affected phases, in addition to unaffected phase. The standard does not prohibit voltage support on unaffected phases. The voltage support on unaffected phase is usually problematic. But the requirement, as written, does not prohibit this.
  - During a L-G fault, current in a faulted phase is dependent on transformer winding configuration. Does this requirement, unintentionally, specify specific transformer configuration?
- During mandatory operation, voltage is abnormal and could be almost zero for close-in faults. As such, “current” over “power” is more appropriate. Power in faulted and unfaulted phases could be different as well. Replace real and reactive power with active (real) and reactive current respectively.

#### G. Requirement R2, Part 2.3.1

- Per language in attachment 1, permissive operation is allowed when line-to-ground or line-to-line voltage is below 10%. But per Part 2.3.1, IBR is required to restart current exchange when positive-sequence voltage enters continuous or mandatory operation region. This is conflicting. For example, for a line-to-ground fault on high-side terminals of main power transformer, the positive-sequence voltage would be more than 10%, i.e., in the mandatory operation region.

#### H. Requirement R2, Part 2.4

- The intent of this requirement is understood. However, if there are multiple plants in the area, then one plant misbehaving may cause overvoltage on high-side terminals of the main power transformer of other plants in the area. Also, the post-fault dynamics greatly depend on system operating condition (peak, shoulder, off-peak, etc.) along with transmission outages, status of capacitor banks, etc. The Generator Owner usually does not have system data to evaluate post-fault system dynamics and to determine if plant’s behavior is or not a contributing factor to overvoltage.

#### I. Requirement R3

- Refer to comments on R1 that could be extended to requirement R3.
- The proposed frequency ride-through requirement is more stringent than the applicable requirement in IEEE Std 2800-2022. The justification provided in the technical rationale is based on engineering judgement with no provided substantiating studies. Furthermore, the PRC-006

requires the design of UFLS program to keep frequency within certain bounds. Requiring IBRs to ride-through a slightly more frequency deviation compared to frequency deviation band allowed in PRC-006 seems reasonable. However, the proposed frequency ride-through requirement is much more stringent. Consider aligning with IEEE Std 2800 frequency ride-through requirement as a minimum requirement and let regions specify more stringent requirements where justified.

- The standard does not allow exception for frequency ride-through requirements. While the physical strain on legacy IBR plants to ride-through frequency disturbances may be less significant compared to the strain during voltage ride-through, the capabilities of legacy IBR hardware (including wind-turbine generators, inverters, transformers, and auxiliary equipment like fans and pumps for cooling, if present) are, at best, uncertain. For plants in commercial operation before the effective date of this standard, installed equipment may not have been tested to the specified frequency ride-through capability and that could make determining if a legacy IBR plant would be able to ride-through proposed frequency ride-through requirements challenging.
  - The SDT points to directive in FERC order 901 and states that order 901 does not allow exception for frequency ride-through. However, order 901 does not require frequency ride-through requirements as stringent as the ones proposed.
  - It is also not clear to us from the record in RM22-12 whether FERC intentionally limited the exemption from ride-through to only voltage ride-through, and on what technical grounds the exemption did not also include frequency ride-through.[4],[5],[6]
- Footnote 9 could be simplified as following: *The ROCOF is an average rate of change of frequency over an averaging window of at least 0.1 second.*

#### J. Requirement R4

- We re-iterate the following observations related to the Effective Date and Phased-in Compliance Dates stated in the Implementation Plan of the project, as previously offered in our EPRI comments on the initial draft of PRC-029:
  - Aligned with the directives to NERC in FERC order 901, the draft proposes that all requirements specified in PRC-029 apply to all applicable IBRs upon the standard's effective date, including Legacy IBRs that were already in operation prior to that date. This approach may require reconfiguration or documentation of hardware limitations for a significant number of existing IBRs across North America. In some cases, for example where the original equipment manufacturer (OEM) of hardware used in Legacy IBRs has gone out of business, or the OEM has ceased to support a legacy hardware product line, documentation of hardware limitations and development of models accurately representing Legacy IBR performance may be challenging. Additional exemptions to address these challenges could be included in R4 of the draft standard or the implementation plan.
  - One example for an alternative approach to the one proposed in the draft PRC-029 could be that TOs and reliability coordinators were to discern on a regional or case-by-case basis about the application of PRC-029 to Legacy IBRs, preferably based on technical evidence like case studies assessing and quantifying the potential BPS reliability impacts from Legacy IBR in their regions.[7] If documentation of Legacy IBR hardware limitations was not available, worst-case assumptions could be made in these case studies. If such studies indicated a viable reliability risk, R4 could be applied to selected or all Legacy IBRs. This could produce documentation of hardware limitations to refine study assumptions to produce more realistic case study results. If refined results still indicated a viable reliability risk, R1-R3 could be applied to Legacy IBRs selectively.

- We refer to our questioning of FERC's intentionality with not including an exemption for frequency ride-through capability per our comments on Requirement R3 above.
- For further comments on the Effective Date and Phased-in Compliance Dates refer to below comments on the Implementation Plan.
- Parts 4.1 and 4.2 refers to exemption for a plant but part 4.3 refers to hardware in plant. If few of many wind-turbine generators in a plant are replaced, then plant still has limitation because most of the wind-turbine generators still have limited capability. Perhaps some clarification could be added that if "all hardware with documented capability limitation" is replaced, only then an exemption for a legacy IBR would not apply any longer.

#### K. Violation Risk Factors

- The language for the assignment of a VRF to Requirement R4 in the draft standard is truncated. Consider revising to: *[Violation Risk Factor: Lower]*
- Each Generator Owner is required per Requirement R4 to identify, document, and communicate about legacy IBRs that have hardware limitations related to the voltage ride-through criteria specified in R1 and R2. Why is a VRF of "Lower" assigned to R4 and not a VRF of "Medium"? Could the uncertainty related to the capability and performance of legacy IBRs associated with a violation of R4 (a requirement that is administrative in nature and a requirement in a planning time frame) by a Generator Owner not, under the abnormal conditions, be expected to



directly and adversely affect the electrical state or capability of the Bulk Power System, or the ability to effectively control the Bulk Power System?

#### L. Violation Severity Levels

- R1, R2, and R3: The lower VSL for each of these requirements is for failure to demonstrate the design capability to ride-through. There are two reasons for which this could arise:
  - (1) Plant is capable to ride-through but is not demonstrated in design evaluation or interconnection studies.
  - (2) Plant is not capable to ride-through and that is demonstrated in design evaluation or interconnection studies.
- Reason (1) is not a problem for grid reliability, it is just that studies are not adequate to demonstrate ride-through capability, and hence lower VSL is justified. But reason (2) is not any different from a case in severe VSL where an entity fails to demonstrate that IBR adhered to ride-through requirements (based on actual system disturbance event data).
- The VSLs could be rephrased to read:
  - Lower VSL: *The Generator Owner failed to produce adequate evidence demonstrating for each applicable IBR that it was designed to Ride-through in accordance with ...*
  - Severe VSL: *The Generator Owner either produced evidence demonstrating for any of their applicable IBR that it was not adequately designed to adhere to Ride-through, or the Generator Owner failed to produce evidence of actual disturbance monitoring data for a specific event that demonstrate each applicable IBR adhered to Ride-through requirements in accordance with ...*

#### M. Attachment 1

- Tables 1 and 2 are inconsistent. Table 1 states “ $\geq 1.10$ ” whereas Table 2 states “ $>1.10$ ”.
- Clarify that cumulative window, for voltage band where ride-through duration is 1800-second, is 3600-second. Also, consider clarifying that 1800-second ride-through duration is only applicable to nominal voltages other than 500 kV.
- Numbered item #3: states that applicable voltage is “... on the AC side of the transformer(s) that is (are) used to connect.....”. Both sides of transformer are AC, one is on DC-AC converter side and another on AC grid side. As written, voltage on either side of transformer is applicable. Please clarify that applicable voltage is on AC “grid” side of the transformer.
- Numbered item #5: Consider revising as following - *The applicable voltage for Tables 1 and 2 is identified as the voltage max/min of phase-to-~~strike: neutral~~ [add: ground] or phase-to-phase fundamental [add: frequency] root mean square (RMS) voltage at the high-side of the main power transformer.*
- Numbered item #7: The interpretation of ride-through curves/points needs further clarification. Would a wind-based IBR plant be required to ride-through an event where at  $t=0$  voltage drops from nominal to zero, then @ $t=0.16$  s voltage rises to 25%, @ $t=1.2$  s voltage rises to 50%, @ $t=2.5$  s voltage rises to 70%, @ $t=3$  s voltage rises to 90%? The item (8) is also tied to item (12), where a combined “area” is stated. Does must ride-through zone represent an “area” (represented by deviation in voltage multiplied by time duration)? Consider adding a few examples in the technical rationale.
  - Note that IEEE 2800-2022, informative Annex D, Section D.1 (Interpretation of voltage ride-through capability requirements specifies) states that the interpretation used in the standard is a “voltage versus time curve.” However, the same Annex includes a Figure D.4 that intends to show “a realistic and complex trajectory of a voltage during a disturbance” for which the informative annex then further states that an IBR plant “is required to ride through,” effectively interpreting the IEEE 2800-2022 ride-through curves as a “voltage versus time envelope.” Thus, there seems to be some ambiguity in IEEE 2800-2022 as to how to interpret its ride-through curves, a finding that could be considered and resolved in a potential future revision or amendment of IEEE 2800.
  - If the voltage ride-through requirements proposed in Attachment 1 were to be specified or interpreted as a “voltage versus time envelope,” and considering that an unknown number of IEEE SA balloters that voted affirmatively on IEEE 2800-2022 may have interpreted the IEEE 2800-2022 requirements as the less stringent “voltage versus time curves” explained in Annex D of the standard, the proposed PRC-029 could be perceived as more stringent than IEEE 2800-2022.
  - Adding a few examples in the technical rationale could help clarify the correct interpretation of the voltage ride-through curves specified in Attachment 1.

- Numbered item 10: Please clarify if this statement applies to protection applied to high side of main power transformer only OR everywhere in the plant.

N. Attachment 2:

- Table 3: To be consistent with other frequency thresholds, could “> 61.2” be “>= 61.2” instead. If so, range for continuous operation then be “< 61.2 and > 58.8”.
- Consider adding a statement that frequency ride-through requirements apply only when voltage is in the must ride-through zone.
- Numbered item 3: What is meant by control settings? Is the intent to state protection settings instead?

O. Implementation Plan

- The proposed revised effective date and newly added phased-in compliance date of the capability-based elements of Requirements R1, R2, and R3 as specified in PRC-029-1 *for primarily new IBRs* of,
  - “the first day of the first calendar quarter that is *twelve months [emphasis added by EPRI]* after” either “the effective date of the applicable governmental authority’s order approving” or “the date the standard is adopted by the NERC Board of Trustees” for (primarily new) Bulk Electric System IBRs, and
  - “until the later of: (1) January 1, 2027; or (2) the effective date of the standard” for (primarily new) Applicable Non-BES IBRs

are different from transition periods found in international practice of similarly significant rule changes for new IBRs. Examples for reference include, but are not limited to:

- - (European) Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators, Article 72 (Entry into force) states, “the requirements of this Regulation shall apply from *three years [emphasis added by EPRI]* after publication.” [8]
  - German Government, “Verordnung zu Systemdienstleistungen durch Windenergieanlagen (Systemdienstleistungsverordnung – SDLWindV) (Ordinance for Ancillary Services of Wind Power Plants (Ancillary Services Ordinance - SDLWindV),”[9]
- Mandatory requirement for new wind power plants to meet specified requirements by March 31, 2011, i.e., *19 months* after ordinance entered into force.
- - ERCOT, “Issue NOGRR245. Inverter-Based Resource (IBR) Ride-Through Requirements. Report of Board Meeting on June 18, 2024,”[10] and ERCOT, “Nodal Operating Guide Revision Request (NOGRR) 245, Inverter-Based Resource (IBR) Ride-Through Requirements. ERCOT Update,” August 8, 2024.”[11]
- All new IBRs with a Standard Generation Interconnection Agreement (SGIA) after August 1, 2024, i.e., *immediately once the NOGRR enters into force* (subject to change until ERCOT board approval and until there is a non-appealable Public Utility Commission of Texas (PUCT) final order is in place)
- Extension of exemption from requirements new IBRs with a Standard Generation Interconnection Agreement (SGIA) after August 1, 2024, does not exceed December 31, 2028, i.e., *4 years and 4 months* (subject to change until ERCOT board approval and until there is a non-appealable Public Utility Commission of Texas (PUCT) final order is in place)
- The proposed revised effective date and newly added phased-in compliance date of the Requirement R4 as specified in PRC-029-1 *for primarily legacy IBRs* of,
  - “the first day of the first calendar quarter that is *twelve months [emphasis added by EPRI]* after” either “the effective date of the applicable governmental authority’s order approving” or “the date the standard is adopted by the NERC Board of Trustees” for (primarily legacy) Bulk Electric System IBRs, and

- “until the later of: (1) January 1, 2027; or (2) the effective date of the standard” for (primarily legacy) Applicable Non-BES IBRs

are either not applicable, or—for re-configurations that do not require replacement of hardware—comparable, or—for retrofits that do require replacement of hardware—they are different from transition periods found in national and international practice of similarly significant retro-active enforcements for legacy IBRs. Examples for reference include, but are not limited to:

- - (European) Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators, Article 4 (Application to existing power-generating modules) states, [12]
- “Existing power-generating modules are not subject to the requirements of this Regulation, except where: ... .”
- “For the purposes of this Regulation, a power-generating module shall be considered existing if:
  - (a) it is already connected to the network on the date of entry into force of this Regulation; or
  - (b) the power-generating facility owner has concluded a final and binding contract for the purchase of the main generating plant by *two years [emphasis added by EPRI]* after the entry into force of the Regulation.
- - German Government, “Verordnung zu Systemdienstleistungen durch Windenergieanlagen (Systemdienstleistungsverordnung – SDLWindV) (Ordinance for Ancillary Services of Wind Power Plants (Ancillary Services Ordinance – SDLWindV)),”[13]
- Financial incentive for voluntary retrofits of legacy wind power plants between July 11, 2009, and January 1, 2011, i.e., *1.5-years*.
- - German Government, “Verordnung zur Gewährleistung der technischen Sicherheit und Systemstabilität des Elektrizitätsversorgungsnetzes (Systemstabilitätsverordnung - SysStabV) (System Stability Regulation – SysStabV)),”[14]
- Mandatory requirement for reconfiguration of legacy IBRs and distributed energy resources (DERs) larger than 100 kW by August 31, 2013, i.e., *13 months* after ordinance entered into force.
- - ERCOT, “Issue NOGRR245. Inverter-Based Resource (IBR) Ride-Through Requirements. Report of Board Meeting on June 18, 2024,”[15] and ERCOT, “Nodal Operating Guide Revision Request (NOGRR) 245, Inverter-Based Resource (IBR) Ride-Through Requirements. ERCOT Update,” August 8, 2024.”[16]
- Mandatory requirement for legacy IBRs with an SGIA executed prior to August 1, 2024 to maximize the performance of their protection systems, controls, and other plant equipment (within equipment limitations) to achieve, as close as reasonably possible, the capability and performance set forth in IEEE 2800-2022 no later than December 31, 2025, i.e., *17 months* after NOGRR enters into force.
- Extension of exemption from requirements for legacy IBRs with a Standard Generation Interconnection Agreement (SGIA) prior to August 1, 2024, does not exceed December 31, 2027, i.e., *3 years and 4 months* (subject to change until ERCOT board approval and until there is a non-appealable Public Utility Commission of Texas (PUCT) final order is in place)
  - The first use of the word “or” in the sentence under the section Effective Date and Phased-in Compliance Dates, PRC-029-1 Phased-in Compliance Dates, Requirement 4, Applicable Non-BES IBRs on page 5 of the Implementation Plan could be replaced for clarity with the word “for” to then read: *Entities shall not be required to comply with Requirement R4 for their non-BES IBRs until the later of: (1) January 1, 2027; or (2) the effective date of the standard.*

- IEEE Std 2800™-2022, a voluntary industry standard for *Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems* is mentioned in the Technical Rationale document for PRC-029-1 but not cited properly. In all instances where the document refers to that IEEE standard, referencing could be improved by following our guidance offered below. Where appropriate, reference to and proper citation of IEEE P2800.2, an active IEEE Standards Association project for developing of a *Recommended Practice for Test and Verification Procedures for Inverter-based Resources (IBRs) Interconnecting with Bulk Power Systems*, may serve as an additional reference.
  - Suggested referencing of IEEE Std 2800™-2022:
    - For the initial citation within any document, we suggest citing the standard as follows: IEEE Std 2800™, IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems
    - Subsequent mentions of the standard could refer to it as: IEEE 2800
  - - Similar guidelines could be applied to IEEE Std 2800.2™:
      - We recommend citing the standard in full on first reference as: IEEE P2800.2, Draft Recommended Practice for Test and Verification Procedures for Inverter-based Resources (IBRs) Interconnecting with Bulk Power Systems
      - Followed by subsequent mentions as: IEEE P2800.2
- Considering the explicit statements in the "PRC-029-1\_Technical\_Rationale" document about the intended alignment with IEEE Std 2800™-2022 requirements in formulating the technical content of PRC-029-1 by the drafting team, references to specific clauses of IEEE Std 2800™-2022 could provide more clarity to industry stakeholders about which parts of the IEEE standard the PRC-029-1 aims to incorporate. It may also be helpful to identify areas where they are not aligned. Refer to the examples in our general comments above.
- IEEE 2800-2022 may not be the only industry standard with scope that overlaps with the proposed PRC-029 standard. ANSI and CIGRE currently may not have related standards. While IEC does have standards and technical specifications with related scope, these documents tend to be less specific in their technical requirements compared to IEEE standards like IEEE 2800-2022.[17]

#### Q. Justifications

- The table for “VRF Justifications for PRC-029-1, Requirement R3” on page 11 of the Justifications lists a Proposed VRF of “Lower”; but the draft PRC-029 standard assigns R3 a “[Violation Risk Factor: High]”. Consider resolving inconsistency across the two documents.
- Refer further to the comment on the VRF assignment for Requirement R4 above.

[1] Grid Codes for Interconnection of Inverter-Based Distributed Energy Resources by Country: Recent Trends and Developments. EPRI. Palo Alto, CA: November 2014. 3002003283. [Online] <https://www.epri.com/research/products/000000003002003283> (last accessed, January 24, 2023)

[2] Dispersed Generation Impact on CE Region Security: Dynamic Study. 2014 Report Update. European Network of Transmission System Operators for Electricity (ENTSO-E), ENTSO-E SPD Report, Brussels, Belgium: December 2014. [Online] [https://eepublicdownloads.entsoe.eu/clean-documents/Publications/SOC/Continental\\_Europe/141113\\_Dispersed\\_Generation\\_Impact\\_on\\_Continental\\_Europe\\_Region\\_Security.pdf](https://eepublicdownloads.entsoe.eu/clean-documents/Publications/SOC/Continental_Europe/141113_Dispersed_Generation_Impact_on_Continental_Europe_Region_Security.pdf) (last accessed, January 24, 2023)

[3] LBNL (2024) [Online] <https://emp.lbl.gov/generation-storage-and-hybrid-capacity>

[4] E-1-RM22-12-000.pdf [Online] <https://www.ferc.gov/media/e-1-rm22-12-000> (last accessed, August 6, 2024)

[5] 20230206-5094\_ACP-SEIA IBR NOPR comments (Final).pdf [Online] <https://elibrary.ferc.gov/eLibrary/filedownload?fileid=49DB8845-A3E3-CEEA-A6D8-86289C500000> (last accessed, August 6, 2024)

[6] E-2-RM22-12-000.pdf [Online] <https://www.ferc.gov/media/e-2-rm22-12-000> (last accessed, August 6, 2024)

[7] EPRI is currently working on case studies relevant to these topics and is also aware of others doing similar work.

[8] ENTSO-E: Requirements for Generators. [Online] [https://www.entsoe.eu/network\\_codes/rfg/](https://www.entsoe.eu/network_codes/rfg/) (last accessed, August 6, 2024)

[9] Federal Law Gazette I (no. 39) (2009): 1734–46. [Online] <https://www.clearingstelle-eeg-kwkg.de/gesetz/695> (last accessed, August 6, 2024)

[10] ERCOT, “Issue NOGRR245. [Online] <https://www.ercot.com/mktrules/issues/NOGRR245> (last accessed, August 9, 2024)

[11] ERCOT, “Nodal Operating Guide Revision Request (NOGRR) 245, Inverter-Based Resource (IBR) Ride-Through Requirements. ERCOT Update,” August 8, 2024 [Online] <https://www.ercot.com/calendar/08082024-NOGRR245--Review-of> (last accessed, August 9, 2024)

[12] Ref. Footnote 10

[13] Federal Law Gazette I (no. 39) (2009): 1734–46. [Online] <https://www.clearingstelle-eeg-kwkg.de/gesetz/695> (last accessed, August 6, 2024)

[14] Federal Law Gazette I (no. 40) (2012): 1635. [Online] <https://www.gesetze-im-internet.de/sysstaby/BJNR163510012.html> (last accessed, August 6, 2024)

[15] Ref. Footnote 16

[16] Ref. Footnote 17

[17] Example IEC standards and technical specifications with related scope may include IEC 61400-27, IEC 62934:2021, IEC TS 63102:2021, and IEC TR 63401-4:2022.

Likes 0

Dislikes 0

### Response

**Scott Thompson - PNM Resources - Public Service Company of New Mexico - 1,3,5 - WECC**

**Answer**

Yes

**Document Name**

**Comment**

PNM agrees with the comments of EEI.

Likes 0

Dislikes 0

### Response

**Nick Leathers - Ameren - Ameren Services - 3 - SERC**

**Answer**

Yes

**Document Name****Comment**

Ameren recommends that the drafting team clarify the phrase "current block mode." Additionally, there is some concern that the technical requirements are so rigid that it might become challenging for utilities to implement a cost effective solution for the entity and customers. Additionally, Ameren supports the responses from both EEI and NAGF for this question.

**R1, bullet point #2:**

R1 suggests that we have to set protection so that we do not trip until capabilities are exceeded, which is not how Ameren sets protection. Ameren sets protection systems to operate before capabilities of equipment are exceeded. In addition, engineers should be setting relays per capabilities of equipment to prevent damage and to maximize their capability. We do not suggest using a generic capability when equipment may have higher capabilities. We suggest replacing the second bullet with the following and removing the last bullet.

"The applicable in-service protection system devices are set to operate to isolate or de-energize equipment in order to limit or prevent damage when the voltage or Volts per Hz (V/Hz) at the high-side of the main power transformer exceed accepted equipment capabilities in accordance with requirement R4; or"

Then add a footnote:

"If the Volts per Hz (V/Hz) withstand capability of the main power transformer is not available for an existing facility, then the applicable in-service protection system may be set to isolate or de-energize equipment if the volts per Hz at the high-side of the main power transformer exceed 1.1 per unit for longer than 45 seconds or exceed 1.18 per-unit for longer than 2 seconds"

**R4, 4.1.2:**

In Ameren's experience, manufacturers are unwilling to share hardware capabilities on the inverter and claim it is proprietary or some other reason. We suggest a re-write of 4.1.2 to add an exclusion such as the following:

"...If the Functional Entity has requested the capability of the hardware limitation, but the manufacturer will not provide the capability, the Functional Entity must provide evidence that they have made the effort to request this information from the manufacturer and provide this in lieu of the capability."

Ameren requests the SDT to provide 2 years to verify compliance with R1, R2, R3 and R4 of the standard since the requirements are extensive.

Likes 0

Dislikes 0

**Response**

**Mohamad Elhousseini - DTE Energy - Detroit Edison Company - 5**

**Answer**

Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Greg Sorenson - Greg Sorenson On Behalf of: Tyler Schwendiman, ReliabilityFirst , 10; - Greg Sorenson**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Hillary Creurer - Allete - Minnesota Power, Inc. - 1**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Benjamin Widder - MGE Energy - Madison Gas and Electric Co. - 3**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Israel Perez - Israel Perez On Behalf of: Laura Somak, Salt River Project, 3, 6, 5, 1; Mathew Weber, Salt River Project, 3, 6, 5, 1; Thomas Johnson, Salt River Project, 3, 6, 5, 1; Timothy Singh, Salt River Project, 3, 6, 5, 1; - Israel Perez**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Gail Elliott - Gail Elliott On Behalf of: Michael Moltane, International Transmission Company Holdings Corporation, 1; - Gail Elliott**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Anna Martinson - MRO - 1,2,3,4,5,6 - MRO, Group Name MRO Group**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Casey Jones - Berkshire Hathaway - NV Energy - 5 - WECC**

**Answer** Yes

**Document Name**

**Comment**

Likes 0

Dislikes 0

**Response**

**Tim Kelley - Tim Kelley On Behalf of: Charles Norton, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Fong Mua, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Kevin Smith, Balancing Authority of Northern California, 1; Nicole Looney, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Ryder Couch, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Wei Shao, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; - Tim Kelley, Group Name SMUD and BANC**



Answer	Yes
Document Name	
Comment	
Likes 0	
Dislikes 0	
Response	
<b>Cain Braveheart - Bonneville Power Administration - 1,3,5,6 - WECC</b>	
Answer	Yes
Document Name	
Comment	
Likes 0	
Dislikes 0	
Response	
<b>Duane Franke - Manitoba Hydro - 1,3,5,6 - MRO</b>	
Answer	Yes
Document Name	
Comment	
Likes 0	
Dislikes 0	
Response	
<b>Bobbi Welch - Midcontinent ISO, Inc. - 2</b>	
Answer	
Document Name	
Comment	
<p>MISO supports the addition of Part 4.2.2.:</p> <p><b>4.2.2</b> Provide a copy of the acceptance of an hardware limitation by the CEA to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s).</p>	

Likes 0

Dislikes 0

**Response**

**Pamela Hunter - Southern Company - Southern Company Services, Inc. - 1,3,5,6 - SERC, Group Name Southern Company**

**Answer**

**Document Name**

**Comment**

Southern Company appreciates the work of the SDT but would like to offer the following changes for consideration:

- There is a risk that changes to the IBR definition under Project 2020-06 may alter the definition for that contained in PRC-029, thus complicating standard implementation.
- Without providing technical justification, a FRT curve is more stringent than IEEE2800. In addition, industry has not been provided with any technical studies justifying the need for the proposed 6-second FRT bands. Southern Company recommends that the SDT align the FRT requirements with IEEE 2800. Individual Regions should be allowed to adopt more stringent FRT standards based on their respective system needs and resource capabilities.
- There is no technical justification for **No FRT** exemptions. (other than the “Regulatory Rationale” provided from FERC 901 Order). Section 215(d) (2) of the FPA requires FERC to give “due weight” to the technical expertise of the ERO when evaluating the content of a proposed Reliability Standard or modification to a Standard.
- The ROCOF requirement may be infeasible for certain legacy IBRs that are unable to disable ROCOF protection and distinguish between fault and non-fault conditions.
- Table 1 and 2 footnote 6 states that the voltage ride through charts are only valid when frequency is within the “must Ride-through zone” as specified in Figure 1 of Attachment 2. The SDT should add a similar footnote to Attachment 2 Table 3 FRT table stating that the frequency ride through charts are only valid when voltage is within the “must Ride-through zone”. Illustrated in the Voltage Ride-through figures.
- In the Implementation Plan, Southern Company recommends extending the capability due date from 12 months of effective date of standard to 18 – 24 months due to expected complexity of solution development and deployment.

Likes 0

Dislikes 0

**Response**

**Martin Sidor - NRG - NRG Energy, Inc. - 6**

**Answer**

**Document Name**

**Comment**

NRG agrees with and refers the SDT to the EPSA comments.

Likes 0

Dislikes 0

**Response**

**Rachel Coyne - Texas Reliability Entity, Inc. - 10**

**Answer**

**Document Name**

**Comment**

Texas RE has the following clarifying comments on PRC-029-1:

- Texas RE recommends correcting Requirement R2 subpart 2.3.1:

2.3.1 If a **an** IBR enters current blocking mode, it shall restart current exchange in less than or equal to five cycles of positive sequence voltage returning to a continuous operation region or mandatory operation region

- In Requirement Part 4.1.1, Texas RE recommends changing “facility #” to “facility unique identifier” or “facility unique number”.
- Texas RE recommends Compliance Enforcement Authority (CEA) should be spelled out in Requirement R4 subpart 4.2 since it is the first time seeing that term in the requirement language.

Likes 0

Dislikes 0

**Response**

**3. Provide any additional comments for the Drafting Team to consider, if desired.**

**Bruce Walkup - Arkansas Electric Cooperative Corporation - 6**

**Answer**

**Document Name**

**Comment**

None.

Likes 0

Dislikes 0

**Response**

**Mark Garza - FirstEnergy - FirstEnergy Corporation - 4, Group Name FE Voter**

**Answer**

**Document Name**

**Comment**

None

Likes 0

Dislikes 0

**Response**

**Jennifer Weber - Tennessee Valley Authority - 1,3,5,6 - SERC**

**Answer**

**Document Name**

**Comment**

N/A

Likes 0

Dislikes 0

**Response**

**Duane Franke - Manitoba Hydro - 1,3,5,6 - MRO**

**Answer**

**Document Name****Comment**

Section 4: Applicability:

4.2 is not aligned with the PRC-028. The DT should consider the alignment of the applicability section between all IBR standards.

1) It is not clear what “The Elements associated with..” means in 4.2.1. Does it mean power system elements?

R2:

The new wording in Section 2.1.3 is unclear.

MH recommends it be changed to “Prioritize Real Power or Reactive Power delivery when the voltage is less than 0.95 per unit, the voltage is within the continuous operating region, and the IBR cannot deliver both Real Power and Reactive Power due to a current limit or Reactive Power limit unless otherwise specified through other mechanisms by an associated Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator.”

R3:

MH is still concerned with the lack of provisions for exemptions for frequency limitation (RoCoF) that may put some of the legacy IBR in a non-compliant state and may require a costly upgrade to meet R3 requirements.

MH recommends the following:

Extending the implementation date for R3 for legacy IBR to 18 months

or/and

Lowering the RoCoF for legacy IBR from 5 Hz /second to 3Hz/ second

R4:

The CEA is not a defined NERC term in the Glossary of Terms Used in NERC standard list, MH recommends spelled out Compliance Enforcement Authority (CEA) in Requirement R4 subpart 4.2 since it is the first time seeing that term in the requirement language.

Attachment #1:

MH agrees with removing the previous figures 1 and 2 from attachment # 1 but we recommend adding at least three voltage waveform examples into TR to illustrate how the Table 1 and 2 should be used to determine the compliance with voltage ride through

TR:

More information should be added to some frequency waveform examples in TR to illustrate how to calculate the RoCoF

Likes 0

Dislikes 0

**Response**

**Donna Wood - Tri-State G and T Association, Inc. - 1**

**Answer**

**Document Name**

**Comment**

Tri-State agrees with the additional comments provided by the MRO NSRF.

Likes 0

Dislikes 0

**Response**

**Sean Bodkin - Dominion - Dominion Resources, Inc. - 6, Group Name Dominion**

**Answer**

**Document Name**

**Comment**

Dominion Energy supports EEI comments.

Likes 0

Dislikes 0

**Response**

**Marcus Bortman - APS - Arizona Public Service Co. - 6**

**Answer**

**Document Name****Comment**

AZPS supports the following comments that were submitted by EEI on behalf of its members:

EEI offers the following additional comments on the proposed 3rd draft of PRC-029-1:

- EEI does not support the inclusion of the phrase “The Elements associated with” as contained in the Facilities Section (4.2.1). The inclusion of this phrase expands the scope in ways that are unclear creating unnecessary compliance confusion.
- Bullet 1 under Requirement R1 is unnecessary and should be deleted, noting that facilities are never obligated to stay connected to a fault.
- EEI asks that the DT provide additional clarity to Requirement R4, subpart 4.2.2 noting that there is insufficient clarity regarding what is needed to support a hardware limitation and what the deadline is for the submission of a limitation.

Likes 0

Dislikes 0

**Response****Andy Thomas - Duke Energy - 1,3,5,6 - SERC,RF****Answer****Document Name****Comment**

Duke Energy agrees with and supports submitted EEI Additional Comments.

Likes 0

Dislikes 0

**Response****Robert Follini - Avista - Avista Corporation - 3****Answer****Document Name****Comment**

none

Likes 0

Dislikes 0

**Response**

**Tim Kelley - Tim Kelley On Behalf of: Charles Norton, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Fong Mua, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Kevin Smith, Balancing Authority of Northern California, 1; Nicole Looney, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Ryder Couch, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; Wei Shao, Sacramento Municipal Utility District, 3, 6, 4, 1, 5; - Tim Kelley, Group Name SMUD and BANC**

<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	



The language in **Section 4, Applicability** does not match the language used in the latest proposed version of PRC-028-1. Although the language in PRC-029-1 is cleaner and preferred, it is not quite clear what is meant by the inclusion of the words “The Elements associated with” in Section 4.2.1. These words are unnecessary.

SMUD would prefer that the drafting team delete these words and change Section 4, Applicability to the language below. The language used in Section 4, Applicability for the currently proposed PRC-028-1, PRC-029-1 and PRC-030-1 should match. This change is non-substantive and could be made in the final ballot.

The existing language in PRC-029-1 (and PRC-030-1) is as follows:

4.1 Functional Entities:

4.1.1. Generator Owner

4.2 Facilities:

4.2.1. ***The Elements associated with*** (1) Bulk Electric System (BES) IBRs; and (2) Non-BES IBRs that either have or contribute to an aggregate nameplate capacity of greater than or equal to 20 MVA, connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage greater than or equal to 60 kV.

The existing language in PRC-028-1 is as follows:

4.1. Functional Entities:

4.1.1. Generator Owner that owns equipment as identified in section 4.2

4.2. Facilities:

4.2.1 BES Inverter-Based Resources

4.2.2 Non-BES Inverter-Based Resources that either have or contribute to an aggregate nameplate capacity of greater than or equal to 20 MVA, connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage greater than or equal to 60 kV

SMUD’s preferred language in PRC-029-1 Section 4, Applicability is as follows:

4.1 Functional Entities:

4.1.1. Generator Owner

4.2. Facilities:

4.2.1 BES Inverter-Based Resources

4.2.2 Non-BES Inverter-Based Resources that either have or contribute to an aggregate nameplate capacity of greater than or equal to 20 MVA, connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage greater than or equal to 60 kV.

SMUD also agrees with the comments submitted by the MRO NSRF on Requirements R2, R3, R4, and Attachment 1.

Dislikes 0

**Response**

**Casey Jones - Berkshire Hathaway - NV Energy - 5 - WECC**

**Answer**

**Document Name**

**Comment**

NV Energy agrees with the NSRF comments especially on the lack of exceptions for legacy IBR systems (R3)

Likes 0

Dislikes 0

**Response**

**Brian Van Gheem - Radian Generation - NA - Not Applicable - NA - Not Applicable**

**Answer**

**Document Name**

**Comment**

1. We believe NERC should coordinate the Implementation Plans for the three standard development projects associated with Milestone 2 of its work plan to address the directives within FERC Order No. 901. This would give most Generator Owners one set of compliance implementation dates to track. The phased-in compliance dates should align with those proposed under NERC Standard Development Project 2021-04, Reliability Standards PRC-002-5 and PRC-028-1, as those dates have been well vented across industry. As that project has proposed for some Generator Owners, this can be as much as within three (3) calendar years of the standard's effective date for 50% of those Generator Owners' BES Inverter-Based Resources. Then the rest of their BES Inverter-Based Resources must be compliant by January 1, 2030. The SDT Project 2021-04 SDT made similar simplifications for other Generator Owners with future IBRs yet to commission and for Category 2 Generator Owners.
2. We point out a misspelling of the work "ride-through" within the first paragraph of the Background Section of the Implementation Plan.
3. Thank you for the opportunity to comment.

Likes 0

Dislikes 0

**Response**

**Hayden Maples - Hayden Maples On Behalf of: Jeremy Harris, Evergy, 3, 5, 1, 6; Kevin Frick, Evergy, 3, 5, 1, 6; Marcus Moor, Evergy, 3, 5, 1, 6; Tiffany Lake, Evergy, 3, 5, 1, 6; - Hayden Maples**

**Answer**

**Document Name**

**Comment**

Evergy supports and incorporates by reference the comments of the Edison Electric Institute (EEI) and Midwest Reliability Organization's NERC Standards Review Forum (MRO NSRF) on question 3

Likes 0

Dislikes 0

**Response**

**Ruchi Shah - AES - AES Corporation - 5**

**Answer**

**Document Name**

**Comment**

- AES CE is concerned by the language in several Measures reading “Each Generator Owner and Transmission Owner have **evidence of actual disturbance monitoring...**”. There will be many plants that do not experience an applicable disturbance before this Standard becomes effective and therefore cannot demonstrate adherence to ride-through requirements as prescribed. We are also concerned about expectations for this Measure as time goes on, are we expected to document and record every applicable disturbance and the asset’s performance? Setting up monitoring/tracking/retention for this portion of the Measures is a huge additional burden that will be ongoing unless clarification is provided.
- OEMs have not been forthcoming with operating limit data/equipment trip capabilities, and will not comment on or approve alternative proposed settings without a significant amount of studies and simulations from the GO first. Due to the lack of information from OEMs, we are concerned that the exemption process in R4 will be impossible to meet within the 12 month timeframe for larger GOs.
- Quality EMT models including all equipment information needed are not available for legacy equipment (inverters, PPCs). Many legacy inverters do not have an EMT model, and those that do have models are not adequately validated against equipment performance. Creation of models is either not supported or can be developed at very high cost. Models created after the inverters were initially released are of inadequate quality because the equipment is no longer able to be in a lab environment.
- To consider this, AESCE suggests that the SDT include exceptions for legacy equipment where the performance may not be predictable specifically due to a lack of modeling or inverter information.

Likes 0

Dislikes 0

**Response**

**Scott Langston - Tallahassee Electric (City of Tallahassee, FL) - 1**

**Answer**

**Document Name**

**Comment**

TAL understands that the committee was following previous precedent of the 20MVA or greater facilities; however, we believe this standard will create undue hardship on utilities who will be required to meet this standard. 20MVA seems like a low threshold for the size of IBRs. TAL believes the impact of IBRs as small as 20 MVA seems minimal to the integrity of the BES.

Likes 0

Dislikes 0

**Response**

**Wayne Sipperly - North American Generator Forum - 5 - MRO,WECC,Texas RE,NPCC,SERC,RF**

<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	
<i>The NAGF has no additional comments.</i>	
Likes 0	
Dislikes 0	
<b>Response</b>	
<b>Alison MacKellar - Constellation - 5</b>	
<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	
Constellation has no additional comments.	
Alison Mackellar on behalf of Constellation Segments 5 and 6	
Likes 0	
Dislikes 0	
<b>Response</b>	
<b>Anna Martinson - MRO - 1,2,3,4,5,6 - MRO, Group Name MRO Group</b>	
<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	

**Section 4: Applicability:**

4.2 is not aligned with the PRC-028. The DT should consider the alignment of the applicability section between all IBR standards.

1) It is not clear to me what “The Elements associated with...” means in 4.2.1. Does it mean power system elements?

**R2** The new wording in Section 2.1.3 is unclear.

MRO NSRF recommends it be changed to “Prioritize Real Power or Reactive Power delivery when the voltage is less than 0.95 per unit, the voltage is within the continuous operating region, and the IBR cannot deliver both Real Power and Reactive Power due to a current limit or Reactive Power limit unless otherwise specified through other mechanisms by an associated Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator.”

**R3** The MRO NSRF is still concerned with the lack of provisions for exemptions for frequency limitation (RoCof) that may put some of the legacy IBR in a non-compliant state and may require a costly upgrade to meet R3 requirements.

MRO NSRF Recommends the adoption of a frequency ride requirement for legacy equipment be delayed until Generator Owners can properly evaluate the capability of legacy equipment.

**R4** The CEA is not a defined NERC term in the Glossary of Terms Used in NERC standard list, MRO NSRF recommends spelling out Compliance Enforcement Authority (CEA) in Requirement R4 subpart 4.2 since it is the first time seeing that term in the requirement language.

**Attachment #1**

MRO NSRF agrees with removing the previous figures 1 and 2 from attachment # 1 but we recommend adding at least three voltage waveform examples into TR to illustrate how the Table 1 and 2 should be used to determine the compliance with voltage ride through

**TR** More information should be added to some frequency waveform examples in TR to illustrate how to calculate the RoCoF.

Likes 0

Dislikes 0

**Response**

**Junji Yamaguchi - Hydro-Quebec (HQ) - 1,5**

**Answer**

**Document Name**

[2020-02\\_Unofficial\\_Comment\\_Form\\_07222024\(HQ\).docx](#)

**Comment**

see attached file

Likes 0

Dislikes 0

**Response**

**Gail Elliott - Gail Elliott On Behalf of: Michael Moltane, International Transmission Company Holdings Corporation, 1; - Gail Elliott**

<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	
R3 refers to "must Ride-through zone" but Attachment 2 does not identify what this zone is.	
Likes 0	
Dislikes 0	
<b>Response</b>	
<b>Kimberly Turco - Constellation - 6</b>	
<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	
Constellation has no additional comments.	
Kimberly Turco on behalf of Constellation Energy Segments 5 and 6.	
Likes 0	
Dislikes 0	
<b>Response</b>	
<b>Benjamin Widder - MGE Energy - Madison Gas and Electric Co. - 3</b>	
<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	
Madison Gas and Electric supports the comments of the MRO NSRF.	
Likes 0	
Dislikes 0	
<b>Response</b>	
<b>Hillary Creurer - Allete - Minnesota Power, Inc. - 1</b>	
<b>Answer</b>	

**Document Name**

**Comment**

MP agrees with MRO's NERC Standards Review Forum's (NSRF) additional comments.

Likes 0

Dislikes 0

**Response**

**Greg Sorenson - Greg Sorenson On Behalf of: Tyler Schwendiman, ReliabilityFirst , 10; - Greg Sorenson**

**Answer**

**Document Name**

**Comment**

RF appreciates the improvements made in this version.

Likes 0

Dislikes 0

**Response**

**Romel Aquino - Edison International - Southern California Edison Company - 3**

**Answer**

**Document Name**

[EEI Near Final Draft Comments \\_ Project 2020-02 PRC-029 Draft 3 \\_ Rev 0f \\_\\_ 8\\_09\\_2024.docx](#)

**Comment**

See comments submitted by the Edison Eclectic Institute in the attached file.

Likes 0

Dislikes 0

**Response**

**Stephanie Kenny - Edison International - Southern California Edison Company - 6**

**Answer**

**Document Name**

**Comment**

See EEI Comments

Likes	0
Dislikes	0
<b>Response</b>	
<b>Kristine Martz - Edison Electric Institute - NA - Not Applicable - NA - Not Applicable</b>	
<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	
<p>EEI offers the following additional comments on the proposed 3rd draft of PRC-029-1:</p> <ul style="list-style-type: none"> <li>• EEI does not support the inclusion of the phrase “The Elements associated with” as contained in the Facilities Section (4.2.1). The inclusion of this phrase expands the scope in ways that are unclear creating unnecessary compliance confusion.</li> <li>• Bullet 1 under Requirement R1 is unnecessary and should be deleted, noting that facilities are never obligated to stay connected to a fault.</li> <li>• EEI asks that the DT provide additional clarity to Requirement R4, subpart 4.2.2 noting that there is insufficient clarity regarding what is needed to support a hardware limitation and what the deadline is for the submission of a limitation.</li> </ul>	
Likes	0
Dislikes	0
<b>Response</b>	
<b>Devin Shines - PPL - Louisville Gas and Electric Co. - 1,3,5,6 - SERC,RF</b>	
<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	



LG&E/KU greatly appreciates the SDT's work and is providing feedback with the intent of providing helpful input that will assist in creating a clearer and more consistent standard to meet the FERC directives. We acknowledge the large number of comments provided and thank the drafting team for their work on this standard. A summary of our most substantive feedback is below:

1. Change R1 to apply to voltage and frequency Ride-through (and renumber R1 -> R3, R2 -> R1, and R3 -> R2).
2. Remove footnote 3 or, at minimum, clarify that current blocking is allowed only if not prohibited by the associated functional entities.
3. Ensure M1 addresses all of the exemptions in R1.
4. Replace "Reactive Power limit" with "apparent power limit" in R2 Part 2.1.3, and restore the "according to the requirements ..." language.
5. R2 Part 2.3 should clarify that current blocking is acceptable only if not prohibited by the associated functional entities.
6. All mentions of continuous, mandatory, and/or permissive operating regions should include a reference to Attachment 1 (e.g., "specified in Attachment 1") since these terms are no longer defined terms.
7. Move R4 Part 4.2.2 up a level (i.e., 4.2.2 -> 4.3, 4.3 -> 4.4) and include a timeline for the GO to notify the associated functional entities after it has received an acceptance or rejection of its hardware limitation.
8. Modify items 1 and 2 in Attachment 1 to better address hybrid plants.
9. Remove the second sentence of item 7 in Attachment 1.
10. Add an item in Attachment 1 defining "deviation".
11. Add an item in Attachment 1 permitting IBRs to trip for consecutive voltage deviations subject to the requirements of the associated functional entities.
12. Add an item in Attachment 2, "Table 3 is only applicable when the voltage is within the "must Ride-through zone" as specified in Attachment 1."
13. Modify Table 3 to match IEEE 2800 requirements.
14. Remove Figure 1.
15. In locations where alternative performance requirements are discussed, either add Transmission Owner to the list of entities or replace the list (TP, PC, RC, or TOP) with "the associated functional entities". It is the TO that is responsible for establishing and evaluating interconnection requirements for interconnecting generation Facilities (FAC-001/002).

Likes 0

Dislikes 0

### Response

**Nick Leathers - Ameren - Ameren Services - 3 - SERC**

**Answer**

**Document Name**

**Comment**

Ameren does not have any additional comments for consideration by the drafting team.

Likes 0

Dislikes 0

### Response

**Christine Kane - WEC Energy Group, Inc. - 3, Group Name WEC Energy Group**

**Answer**

**Document Name**

**Comment**

Each requirement contains statement "...shall **ensure** the design and operation is such that ...". The statement has no quantitative meaning nor direct requirements. Let's take R2.2. or R2.3. for example:

Assuming SDT members own and operate IBRs, please explain WHAT YOU WILL DO to comply with R2.2. and R2.3.

WEC Energy Group requests that the Implementation Guidance document be created and published to help industry better understand this convoluted and unclear standard and how to implement it. Following is an example of a standard being unclear:

*R2. "Each Generator Owner shall ensure the design and operation is such that the voltage performance for each IBR adheres to the following during a voltage excursion, unless a documented hardware limitation exists in accordance with Requirement R4."*

What is defined as "voltage excursion"? Is it the voltage outside the region identified in Attachment 1, or is it something else?

Further, R2.1. goes on to state: "While the voltage at the high-side of the main power transformer remains within the continuous operation region as specified in Attachment 1, each IBR shall..".

If the voltage remains within the "continuous operating region", how is that a "voltage excursion".

Likes 0

Dislikes 0

**Response****Carver Powers - Utility Services, Inc. - 4**

Answer

Document Name

**Comment**

In our entity's review of this project, we are voting in the affirmative. We understand and appreciate that this project addresses important considerations for reliability and security responsiveness. However, we also recognize that this project in its current form presents compliance and performance risks that remain unresolved. While affirmatively supporting this project to address the immediate regulatory assignments tied to FERC Order 901, NERC and the ERO must continue a constructive dialog with industry beyond this vote to truly optimize the impacts of this project on reliability, sustainability, and affordability. We encourage NERC to permit extending the SDT team and project to offer prospective enhancements or revisions to satisfy these compliance and performance risks.

Likes 0

Dislikes 0

**Response****Scott Thompson - PNM Resources - Public Service Company of New Mexico - 1,3,5 - WECC**

Answer

Document Name

**Comment**

PNM agrees with the comments made by EEI.

Likes 0

Dislikes 0

## Response

**Jens Boemer - Electric Power Research Institute - NA - Not Applicable - NA - Not Applicable**

### Answer

#### Document Name

[2020-02\\_EPRI Comments on Draft 3 of NERC PRC-029 \(IBR ride-through\) Reliability Standard.pdf](#)

### Comment

#### I. Introduction

1. The Electric Power Research Institute (EPRI)[1] respectfully submits these comments (This Response) in response to North American Electric Reliability Corporation (NERC)'s request for formal comment on Project 2020-02 Modifications to PRC-024 (Generator Ride-through), issued on July 22, 2024.
2. EPRI closely collaborates with its members inclusive of electric power utilities, Independent System Operators (ISOs), and Regional Transmission Organizations (RTOs), as well as numerous other stakeholders, domestically and internationally. In its role, EPRI conducts independent research and development relating to the generation, delivery, and use of electricity for public benefit by working to help make electricity more reliable, affordable and environmentally safe. EPRI's comments on this topic are technical in nature based upon EPRI's research, development, and demonstration experience over the last 50 years in planning, analyzing, and developing technologies for electric power.
3. EPRI research and technology transfer deliverables are generally accessible on its website to the public, either for free or for purchase, and occasionally subject to licensing, export control, and other requirements.[2] The publicly available and free-of-charge milestone reports from a U.S. Department of Energy (DOE)- and EPRI member-funded research project, Adaptive Protection and Validated Models to Enable Deployment of High Penetrations of Solar PV ("PV-MOD"), [3] and other research deliverables substantiate many of the comments made in This Response.
4. While not a standards development organization (SDO), EPRI conducts research and demonstration projects in relevant areas as well as facilitates knowledge transfer and collaboration that SDOs may, at times, use to inform technical and regulatory standards development, such as in Institute of Electrical and Electronics Engineers (IEEE), International Electrotechnical Commission (IEC), International Council on Large Electric Systems (CIGRE), and NERC.[4]
5. EPRI's comments in This Response address reliability and NERC's draft PRC-029 Reliability Standards for IBRs ride-through requirements developed under project 2020-02. All comments are aimed at providing independent technical information to respond to the draft published by NERC based on EPRI's research and development results and associated staff expertise and do not necessarily reflect the opinions of those supporting and working with EPRI to conduct collaborative research and development. Where appropriate, EPRI's comments do not only address the specific questions of the NOPR but also related scope that may help to inform a final order. Some of EPRI's comments presented in This Response have also been submitted in response to the previous Federal Energy Regulatory Commission's (FERC) Notice of Proposed Rulemaking (NOPR) to direct North American Electric Reliability Corporation (NERC) to develop Reliability Standards for inverter-based resources (IBRs) that cover data sharing, model validation, planning and operational studies, and performance requirements (RM22-12), issued on November 17, 2022.
6. EPRI also submitted comments on the initial draft of PRC-029 which was issued on March 27, 2024, and on Draft 2 which was issued June 18, 2024. This 3rd set of EPRI comments supports the same direction as the previously submitted comments and offers a technical analysis based on the latest "Draft 3".[5]

## II. Conclusion

7. EPRI appreciates the opportunity to provide NERC with its technical recommendations and comments on these important topics related to Reliability Standards for IBRs. EPRI looks forward to working with its members, NERC, and other stakeholders on providing further independent technical information on these important questions.

## III. Contact Information

Jens C. Boemer, Technical Executive

Manish Patel, Technical Executive

Anish Gaikwad, Deputy Director

Aidan Tuohy, Director, R&D

EPRI

3420 Hillview Ave

Palo Alto, CA 94304

Email: [JBoemer@epri.com](mailto:JBoemer@epri.com), [ManPatel@epri.com](mailto:ManPatel@epri.com), [AGaikwad@epri.com](mailto:AGaikwad@epri.com), [ATuohy@epri.com](mailto:ATuohy@epri.com)

Robert Chapman, Senior Vice President, Corporate Affairs

EPRI

3420 Hillview Ave

Palo Alto, CA 94304

Email: [RChapman@epri.com](mailto:RChapman@epri.com)

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[2] <https://www.epri.com> (last accessed, August 6, 2024)

[3] PV-MOD Project Website. EPRI. Palo Alto, CA: 2024. [Online] <https://www.epri.com/pvmod> (last accessed, August 6, 2024)

[4] For transparency, we would like to disclose that EPRI collaborates with other organizations such as IEEE, IEC, CIGRE, and NERC; however, EPRI is not a regulatory- or standard-setting organization. EPRI research is often considered in the development of recommendations, guidelines, and best practices that are not determinative.

[5] [https://www.nerc.com/pa/Stand/Pages/Project\\_2020-02\\_Transmission-connected\\_Resources.aspx](https://www.nerc.com/pa/Stand/Pages/Project_2020-02_Transmission-connected_Resources.aspx)

Likes 0

Dislikes 0

### Response

**Constantin Chitescu - Ontario Power Generation Inc. - 5**

Answer

Document Name

Comment

OPG supports NPCC Regional Standards Committee's comments.

Likes 0

Dislikes 0

### Response

**Ruida Shu - Northeast Power Coordinating Council - 1,2,3,4,5,6,7,8,9,10 - NPCC, Group Name NPCC RSC**

Answer

Document Name

Comment

NPCC RSC supports the project.

Likes 0

Dislikes 0

### Response

**Mike Magruder - Avista - Avista Corporation - 1**

Answer

Document Name

Comment

We concur with EEI's comments.

Likes 0

Dislikes 0

**Response**

**Pamela Hunter - Southern Company - Southern Company Services, Inc. - 1,3,5,6 - SERC, Group Name** Southern Company

**Answer**

**Document Name**

**Comment**

Southern Company received the following feedback from one of our OEM providers relating to the Frequency Ride-Through requirements in PRC-029:

"...confirms that **neither** its legacy nor new turbines can meet the proposed frequency ride-through requirements. Wind turbines contain hundreds of electromechanical devices that must be redesigned and tested before any new stringent frequency ride-through zones can be confirmed."

"...is currently designing and evaluating our turbines' capabilities according to **IEEE 2800** standards. Consequently, any new requirements deviating from IEEE 2800 will be unfeasible in the near term."

Likes 0

Dislikes 0

**Response**

**Colin Chilcoat - Invenergy LLC - 6**

**Answer**

**Document Name**

**Comment**

Invenergy thanks the drafting team for the opportunity to provide the above comments.

Likes 0

Dislikes 0

**Response**

**Rhonda Jones - Invenergy LLC - 5**

**Answer**

**Document Name**

**Comment**

Invenergy thanks the drafting team for the opportunity to provide the above comments.

Likes 0

Dislikes 0

**Response**

**Jodirah Green - ACES Power Marketing - 1,3,4,5,6 - MRO,WECC,Texas RE,SERC,RF, Group Name ACES Collaborators**

**Answer**

**Document Name**

**Comment**

Thank you for the opportunity to comment.

Likes 0

Dislikes 0

**Response**

**George E Brown - Pattern Operators LP - 5**

**Answer**

**Document Name**

**Comment**

Pattern Energy supports Edison Electric Institute's and Grid Strategies LLC's comments.

Likes 0

Dislikes 0

**Response**

**Jennifer Bray - Arizona Electric Power Cooperative, Inc. - 1**

**Answer**

**Document Name**

**Comment**

Thank you for the opportunity to comment.

Likes 0

Dislikes 0

**Response**

**Charles Yeung - Southwest Power Pool, Inc. (RTO) - 2 - MRO,WECC,Texas RE,NPCC,SERC,RF, Group Name SRC 2024**

**Answer**

**Document Name**

**Comment**

In the previous posting, the SRC provided this comment which was not addressed in the current version for comment and ballot:

Attachment 1 lists a minimum ride-through time of 1800 seconds for the continuous operation voltage region between 1.05 pu and 1.1 pu ( $\leq 1.1$  and  $>1.05$ ) in Tables 1 and 2. The SRC requests that, consistent with IEEE 2800, an exception for 500 kV systems be allowed such that the minimum ride-through time for  $1.05 \text{ pu} < \text{voltage} \leq 1.1 \text{ pu}$  for 500 kV systems is "Continuous," because the  $1.05 \text{ pu} < \text{voltage} \leq 1.1 \text{ pu}$  voltage range is within the normal operation range for some systems, such as PJM's system.

The SRC again requests the exception for 500KV systems be incorporated. The SDT has not explained why this difference from the IEEE 2800 is appropriate for 500 KV reliability.

We recommend the M1 references to Sequence Event Recorder, Dynamic Disturbance Recorder, and Fault Recorder be adjusted to lower case terms, as these are not defined in the Glossary of Terms. PRC 28 utilizes acronyms for these that may be appropriate for this standard. Similarly a change was made in R4 to replace Regional Entity with CEA, which is an undefined term and acronym in the Glossary. Suggest spelling this out and considering defining or pointing to the Rules of Procedure.

Likes 0

Dislikes 0

**Response**

**Srinivas Kappagantula - Arevon Energy - 5**

**Answer**

**Document Name**

**Comment**

None.

Likes 0

Dislikes 0

**Response**



**Bobbi Welch - Midcontinent ISO, Inc. - 2**

**Answer**

**Document Name**

**Comment**

MISO understands the increased need for Ride-through capabilities as system inertia decreases. We also see challenges for equipment to demonstrate compatibility with the frequency requirements (Attachment 2) which go beyond industry standards (IEEE 2800) and MISO's current Tariff requirements. MISO's plan for conformity currently relies on IEEE P2800.2 and we are planning to use that as the basis for testing to ensure IBRs meet MISO Tariff requirements. We ask that consideration be given to aligning PRC-029 with other existing industry standards.

Likes 0

Dislikes 0

**Response**

**Marty Hostler - Northern California Power Agency - 3,4,5,6**

**Answer**

**Document Name**

**Comment**

Regarding the Implementation Plan. Six months after FERC approval is unreasonable to have equipment and procedures in place and changes made. Especially considering several entities will need to order and install new monitoring equipment from most likely the same companies. This implementation plan should be the same as PRC-28.

NCPA understands Ferc Order 901. The SDT has not provided any cost or expected reliability indices improvement estimates. Consequently, it is impossible for entities to determine if this proposal is cost effective to address recommendations of FERC order 901 or if, or to what extent, this proposal will improve reliability.

Reliability standards should not be added or changed until the SDT provides said information so that Registered Entities can make educated determinations related to the cost and benefits of reliability standard modifications or new proposals.

The SDT has not provide a cost or tangible reliability benefit estimate. Thus we are unable to analyze the cost and reliability benefits this proposal would provide without any data. And, ironically GO/GOP IBR Entities are being asked to spend money to procure and install a bunch of devices to record data and/or to perform new activities that may, or may not, improve reliability. And if they do improve reliability, we don't have any idea if the reliability benefits are worth the cost. Electricity customers' rates would need to be raised and there is no justification or hard evidence related to the improved reliability increase magnitude; i.e. no cost/benefit justification to provide electricity customers as to why their rates are increasing.

Likes 0

Dislikes 0

**Response**

Answer

Document Name

Comment

WECC believes that PRC-029 does a good job being consistent on use of IBR (and PRC-028 and PRC-030 DTs should take note on consistency.) Note that the redlined version of the posted Standard did not capitalize “reactive power” in M2 but the clean version did. Another example is Footnote 11 in the redline version used “active power” but clean version was changed to “Real Power”. DT could receive responses based on either document and needs to ensure consistency in the clean version or note the differences.

WECC suggests that Requirement 4 could be removed and listed as actions to be done within the Implementation Plan. From an auditing perspective, noncompliance is based on administrative issues (failure to provide in 12 months) and is only applicable to units already “in-service” as of the effective date. “In-service” is meant to be exactly what? (WECC has an applicable term in the NERC Glossary, but that is only applicable in the Western Interconnection. Different entities may have a different definition of "in-service." Suggest a definition be developed.) First synch date the IBR is “in-service”. Reliability issues can happen with units not at the COD date and this issue should not be ignored or exacerbated by assuming, if that is the case, that “in-service” equated to COD. There will be discussions as to what the effective date is (for R4 specifically) due to the Implementation Plan dependence provided by the DT. This again calls for a timeline to be provided for each Standard being considered especially for these IBR-related Standards as the IPs are not clearly defined. Still not clear why CEAs need notification of hardware limitations within a Standard. A onetime Alert for R4 may be appropriate followed up by a Periodic Data Submittal when hardware issues are alleviated (currently no response to CEA is required which begs the question why inform them in the first place?). Severe VSL needs to remove CEA as a result of not being in the section for responses required.

VSLs for R3 need to be adjusted to use “IBR” versus “facility”. VSLs for R4 indicated a basis of effective date of R4 versus effective date of Standard as the language of the Standard states. This needs corrected as those dates may be different. Another clear reason to provide a timeline diagram of Implementation Plan dates.

Attachment 2 Bullet 1 for Voltage- Is the “that include wind” limited to type 3 and type 4 for the hybrid aspect?

Attachment 2 Bullet 4 for frequency—Need to replace “facility” with IBR.

PRC-029 Implementation Plan Requirement 4 “Non-BES IBRs”- Need to change “or” to “for” in the sentence describing R4’s timeline for implementation. Bottom of page 5 capitalize “ride-through”.

All BES IBRs, including those that have repeatedly failed from a performance perspective, default to the PRC-028 timeline which employs an extended timeframe for phased-in implementation.

PRC-029 Implementation Plan- Separating the Requirements compliance obligation timeframe out by design and operation is not realistic and gives the false appearance of being partially applicable prior to Jan 1, 2030. The language of the Requirements, as written, will be contested by entities as the language requires both the “design and operation” for BES IBRs and non-BES IBRs. Effectively a review of the design will be an administrative effort for an item that could be designed today but there is no quality or accuracy language for the design aspects. The proof that design was completed in an effective manner to mitigate the risk can only be determined if an event occurs. R4 has additional implementation time built into the Requirement language which provides a false appearance of being applicable on the effective date of the Standard.

Likes 0

Dislikes 0

Response

Jennifer Neville - Western Area Power Administration - 1,6

Answer

Comment

**Section 4:** Applicability:

{C}4.2 {C}is not aligned with the PRC-028. The DT should consider the alignment of the applicability section between all IBR standards.

{C}1) It is not clear to me what “The Elements associated with...” means in 4.2.1. Does it mean power system elements?

**R2** The new wording in Section 2.1.3 is unclear.

MRO NSRF recommends it be changed to “Prioritize Real Power or Reactive Power delivery when the voltage is less than 0.95 per unit, the voltage is within the continuous operating region, and the IBR cannot deliver both Real Power and Reactive Power due to a current limit or Reactive Power limit unless otherwise specified through other mechanisms by an associated Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator.”

**R3** The MRO NSRF is still concerned with the lack of provisions for exemptions for frequency limitation (RoCof) that may put some of the legacy IBR in a non-compliant state and may require a costly upgrade to meet R3 requirements.

MRO NSRF Recommends the adoption of a frequency ride requirement for legacy equipment be delayed until Generator Owners can properly evaluate the capability of legacy equipment.

**R4** The CEA is not a defined NERC term in the Glossary of Terms Used in NERC standard list, MRO NSRF recommends spelling out Compliance Enforcement Authority (CEA) in Requirement R4 subpart 4.2 since it is the first time seeing that term in the requirement language.

**Attachment #1**

MRO NSRF agrees with removing the previous figures 1 and 2 from attachment # 1 but we recommend adding at least three voltage waveform examples into TR to illustrate how the Table 1 and 2 should be used to determine the compliance with voltage ride through

**TR** More information should be added to some frequency waveform examples in TR to illustrate how to calculate the RoCoF.

Likes 0

Dislikes 0

**Response**

<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	
ERCOT joins the comments submitted by the IRC SRC and adopts them as its own. In addition, ERCOT encourages NERC to consider defining the averaging window for Rate of Change of Frequency, as leaving the averaging window open ended will result in measurement inconsistencies in protection systems and post-event analysis.	
Likes 0	
Dislikes 0	
<b>Response</b>	
<b>Kyle Thomas - Elevate Energy Consulting - NA - Not Applicable - NA - Not Applicable</b>	
<b>Answer</b>	
<b>Document Name</b>	
<b>Comment</b>	

**Elevate continues to strongly encourage NERC to reconsider adoption of IEEE 2800-2022.** The unwillingness to adopt IEEE 2800-2022 by NERC is leading to entirely duplicative efforts that are not serving any additional value as compared to the work conducted in the IEEE 2800-2022 developments. It does not appear that a holistic approach and strategy is being taken to meet the FERC Order No. 901 directives, which is leading to very low ballot scores, significant rework, and misalignment with industry recommended practices.

The draft NERC PRC-029 is duplicative with IEEE 2800-2022 Clause 7 yet only covers a small fraction of the IBR-specific capability/performance requirements and necessary equipment limitation details that are outlined in that clause. Therefore, there is no clear reliability benefit versus the cost of implementation PRC-029 as compared with IEEE 2800-2022 and the recommendations set forth in the NERC disturbance reports and guidelines. There are three core items that should be addressed in the draft NERC PRC-029 standard:

- Requirement R4 of the standard be updated to include frequency ride-through criteria exemptions for IBRs in-service by the effective date of the standard that have known hardware limitations.
- The draft PRC-029 standard should align the FRT curve with the IEEE 2800 standard's FRT curve
- If necessary, the "maximization" concept could be introduced to maximize the capabilities of legacy IBRs to the available software/firmware/setting limits.

**Elevate strongly recommends a single NERC standard that adopts IEEE 2800-2022 in a uniform and consistent manner.** NERC can also issue a reliability guideline or implementation guidance that supports industry implementation of the standard. Rather than recreate parts of IEEE 2800-2022 inconsistently over multiple different standards, Elevate recommends a singular standard for BPS-connected IBR capability and performance requirements related to IEEE 2800-2022. Additional NERC standards can be developed where needed in situations where they are not covered directly with IEEE 2800-2022 (e.g., NERC PRC-030).

### Concerns with Draft PRC-029

If the draft PRC-029 standard is to be pursued as currently structured, Elevate would like to highlight the following concerns:

**Inconsistencies with PRC-029 and IEEE 2800-2022:** There are numerous inconsistencies in the draft standard language and attachment 1 and 2 when compared to IEEE 2800-2022. These should be considered and reviewed for clarity and completeness in the standard.

- IEEE 2800 recognizes FRT requirement limitations, but the standard does not
- IEEE 2800 recognizes limitations with VSC-HVDC equipment in meeting consecutive voltage deviation ride-through capability, the PRC-029 standard does not.
- IEEE 2800 allows for an exception for "self-protection" when negative-sequence voltage is greater than specified duration and threshold, which may be required for Type III WTG based plants. PRC-029 does not have this exception.
- IEEE 2800 recognizes 500kV system voltages are actually operated in the range of 525kV and therefore has equipment rated to 550kV. These 500kV operating conditions and corresponding updated voltage ride-through curves should be considered in the standard.
- In IEEE 2800 the frequency ride-through criteria defines 10-minute time periods for the cumulative specifications of FRT, whereas the standard defines them in a 15 minute time period (Table 3 of Attachment 2). This should be clarified and identified.
- IEEE 2800 has an exception on IBR post-disturbance current limitations for voltage disturbances that reduce RPA voltage to less than 50% of nominal, but the standard does not have this exception.
- A ride-through duration of 1800 seconds is specified in both IEEE 2800 and draft PRC-029 for  $V > 1.05$  and  $\leq 1.10$ . PRC-029 is silent on the cumulative time period for this requirement, whereas IEEE 2800-2022 specifies that this is cumulative over a 3600 second time period.
- Attachment 2: frequency ride-through criteria should be updated to fully match with IEEE 2800. Creating a different FRT ride-through curve without adequate technical justification will continue to challenge the industry.
- The standard should be updated to explicitly state that the voltage ride-through curves are to be interpreted as voltage vs time duration as is stated in IEEE 2800. This is to ensure that there is no incorrect interpretation that these curves are "envelope" curves. This could be done by adding a new note to explicitly call out the voltage vs time duration interpretation of the curves.

Likes 0

Dislikes 0

**Response**

**Bill Zuretti - Electric Power Supply Association - 5**

**Answer**

**Document Name**

[EPSA FINAL Comments on IBR Standards .pdf](#)

**Comment**

Likes 0

Dislikes 0

**Response**

