

Board of Directors Meeting Agenda Salt Lake City, Utah

Meeting link, Password: WECC | Dial-in Number: 1-415-655-0003, Attendee Access Code: 2867 059 4596

December 11, 2024, 9:00 a.m. to 12:00 p.m. Mountain Time

1. Welcome, Call to Order-Ric Campbell

2. Review WECC Antitrust Policy—Jeff Droubay

WECC Antitrust Policy.

Please contact WECC legal counsel if you have any questions.

- 3. Approve Agenda
- 4. Consent Agenda

Approval Item: Meeting Minutes from September 17, 2024

- 5. Review of December 10, 2024, Closed Session-Ric Campbell
- 6. FERC Remarks—Kal Ayoub, Director, Office of Electric Reliability

7. Remarks and Reports

WECC President and CEO—Melanie Frye

Reliability and Security Oversight-Steven Noess

Break

Member Advisory Committee–Brian Theaker

Approval Item: Member Advisory Committee (MAC) Charter

Western Interconnection Regional Advisory Body-Eric Baran

Western Interconnection Compliance Forum–Layna McVay

8. Public Comment

9. WECC Long-term Strategy—Jeff Droubay

Approval Item: WECC Long-term Strategy

<Public>

Board Meeting Agenda-December 11, 2024

10. Board Committee Reports

Finance and Audit Committee-Richard Woodward

Approval Item: Finance and Audit Committee (FAC) Charter

Governance Committee—Ian McKay

Approval Item: Governance Committee (GC) Charter

Approval Item: Section 4.9 Review Work Group Composition and Scope

Human Resources and Compensation Committee-Felicia Marcus

Approval Item: Human Resources and Compensation Committee (HRCC) Charter

Approval Item: Appointment of Officers

Approval Item: 2025 Corporate Scorecard

Nominating Committee—Ian McKay

Standards Committee – Joe McArthur

WECC Standards Committee (WSC) Charter

11. Technical Activities Update

Reliability Planning and Performance Analysis—Branden Sudduth Reliability Assessments Committee—Chelsea Loomis Reliability Risk Committee—Meg Albright

12. Review New Action Items

13. Review Upcoming Meetings

March 11–12, 2025	Salt Lake City, Utah
June 10–11, 2025	Salt Lake City, Utah
September 17–18, 2025	Salt Lake City, Utah

14. Adjourn





Board of Directors Meeting Approval Item Consent Agenda December 11, 2024

Board Resolution

The consent agenda for this meeting consists of:

Approval of September 17, 2024, minutes.

Recommendation

Staff believes that these items do not require additional Board discussion, and each is non-controversial and appropriate for the consent agenda. Attached is background information on each item.

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Board of Directors DRAFT Meeting Minutes September 17, 2024 Salt Lake City, Utah

1. Welcome, Call to Order

Ric Campbell, Board of Directors (Board Chair), called the meeting to order at 12:45 p.m. MT on September 17, 2024. A quorum was present to conduct business. A list of attendees is attached as Exhibit A.

2. Review WECC Antitrust Policy

Jeff Droubay, Vice President and General Counsel, read aloud the WECC Antitrust Policy statement. The meeting agenda included a link to the posted policy.

3. Approve Agenda

Mr. Campbell introduced the proposed meeting agenda.

On a motion by Felicia Marcus, the Board approved the agenda.

4. Consent Agenda

Mr. Campbell introduced the consent agenda.

On a motion by Shelley Longmuir, the Board approved the consent agenda, which consisted of:

Approval Item: Minutes from June 12, 2024

5. September 17, 2024, Closed Session

Mr. Campbell reviewed the closed session held the morning of September 17, 2024.

6. NERC Trustee Remarks

Jim Piro, NERC Trustee, provided an update on the draft ERO Enterprise Long-term Strategy (ERO LTS), standards development process, and the Interregional Transfer Capability Study (ITCS). Mr. Piro responded to questions about winterization, gas-coordination and capacity issues, and enterprise risk activities pertaining to artificial intelligence (AI).

7. Remarks and Reports

The following people gave reports to the Board:

Board Meeting Minutes-September 17, 2024

a. Melanie Frye, President and CEO, reported that three key positions integral to WECC's invented future have been filled: Amanda Shephard, Manager of Communications; Trisha Brimhall, Director, Human Resources, People and Culture; and Adam Jensen, Controller, Finance and Accounting. Ms. Frye summarized the ERO LTS and presented a resolution for Board endorsement of the ERO LTS. Ms. Frye responded to questions on next steps for the ERO LTS.

On a motion by Gary Leidich, the Board approved the following resolution:

Resolved, that the WECC Board of Directors (Board) endorses the ERO Enterprise Long-term Strategy.

Ms. Frye proceeded with updates on the Western Transmission Expansion Coalition (WestTEC) project; summarized FERC, NERC, regional, and international activities; and closed with a high-level update on 2024 Scorecard progress. Ms. Frye responded to questions on scorecard progress, Black Start resources, succession and development plans for critical positions, and hybrid workforce challenges. The Board commended WECC on progress on external outreach efforts;

- b. Steven Noess, Vice President Reliability and Security Oversight, provided an update on compliance trends observations, Inverter-based Resources (IBR) Work Plan milestones, cold weather preparedness requirements and outreach efforts, and self-logging processing. The Board asked about self-logging participants, lessons learned from cold weather standards development, solar trending, and solar registration approach.
- c. Michele Beck, Member Advisory Committee (MAC) Chair, summarized the MAC's 2024 accomplishments and ongoing work. Ms. Beck requested continued Board support in seeking MAC advice; and
- d. Laura Rennick, Western Interconnection Regional Advisory Body (WIRAB) Executive Director, stated WIRAB support for the dissolution of the Joint Guidance Committee (JGC), provided an update on the IBR gap analysis project report, and extended an invitation to the CREPC-WIRAB meeting in October 2024.

8. Long-term Strategy Refresh

Mr. Droubay provided an update on the process, strategy, and intent of WECC's draft Longterm Strategy (WECC LTS). Mr. Droubay responded to questions about how the WECC LTS translates into "what" WECC will do versus "who" WECC is, how the scorecard ties into the WECC LTS, connections to the ERO LTS, and tying items that are unique to the West into the WECC LTS.



Board Meeting Minutes-September 17, 2024

9. Public Comment

Fred Heutte, Northwest Energy, commented on the WECC LTS and suggested looking at the changes happening in different regions and integrating into the WECC LTS.

10. Board Committee Reports

Board committee reports were provided:

a. Finance and Audit Committee

Gary Leidich, Finance and Audit Committee (FAC) Chair, reported that no meeting was held, but that year-to-date financial results were included as part of the Board materials.

b. Governance Committee

Felicia Marcus, Governance Committee (GC) Chair, reported that no meeting was held. Mr. Campbell noted that the GC will undertake the Section 4.9 Review and that work on the 4.9 Review will begin in the fourth quarter.

c. Human Resources and Compensation Committee

Shelley Longmuir, HRCC Chair, reviewed the HRCC closed session meeting held earlier on September 17, 2024, where the HRCC discussed compensation issues, reviewed draft 2025 CEO goals, and received a report on WECC's 401(k) Plan performance.

d. WECC Standards Committee

Ian McKay, WECC Standards Committee (WSC) Chair, reviewed WSC activities and summarized the meeting held on September 6, 2024.

11. Technical Activities Update

Branden Sudduth, Vice President of Reliability Planning and Performance Assessment, provided a technical activities report, including updates on the functionality of the enhanced System Performance Data Portal, and summarized two transmission assessment activities: the ITCS and WestTEC. Mr. Leidich spoke on being mindful that the ITCS is a technical study, and we want to guard against it being used as a political tool. Mr. Sudduth summarized national activities, including Section 321 of the Rules of Procedure, and NERC alerts for IBRs. Mr. Sudduth responded to questions on the NERC Technical Conference.

Additional reports were provided as follows:

a. Mr. Sudduth and Chelsea Loomis, JGC, Co-chairs, summarized an evaluation performed by the JGC or its own work in which the JGC concluded that the Reliability Assessment Committee (RAC) and Reliability Risk Committee (RRC) are coordinating well, thus



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Board Meeting Minutes-September 17, 2024

obviating the need for JGC coordination. Mr. Sudduth and Ms. Loomis recommended that the JGC be dissolved.

On a motion by Ian McKay, the Board approved the following resolution:

Resolved, that the WECC Board of Directors, acting on the recommendation of the Joint Guidance Committee (JGC) at the meeting of the Board on September 17, 2024, approves the dissolution of the JGC and retirement of the JGC Charter.

- b. Philip Augustin, RAC Co-chair, reported on RAC activities and accomplishments, including the Anchor Data Set (ADS), and enhancing data quality and completeness; and
- c. Dede Subakti, RRC Co-chair, highlighted joint RRC and RAC activities and RRC efforts to improve the risk register process. Ms. Subakti responded to questions on RAC and RRC coordination.

12. Board Leadership Election

Mr. McKay, Director, reported that each year the Board elects Board leadership and, in accordance with the Board Governance Guidelines, he canvassed each director and affirmed that Ric Campbell and Jim Avery are willing to stand for election in the Board leadership positions.

On a motion by Ian McKay, the Board elected Ric Campbell as chair. Mr. Campbell abstained.

On a motion by Ric Campbell, the Board elected Jim Avery as vice chair. Mr. Avery abstained.

13. Review New Action Items

There was no new action items created during this meeting.

14. Upcoming Meetings

December 10–11, 2024	Salt Lake City, Utah
March 11–12, 2024	Salt Lake City, Utah
June 10–11, 2024	Salt Lake City, Utah

15. Adjourn

Mr. Campbell honored Shelley Longmuir and Gary Leidich, outgoing Directors, and summarized their amazing work and successes at WECC. The Board thanked Mr. Leidich and Ms. Longmuir for their time, efforts, and commitment.

Mr. Campbell adjourned the meeting without objection at 3:18 p.m.



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Board Meeting Minutes-September 17, 2024

Exhibit A: Attendance List

Members in Attendance

James Avery	Vice Chair
Ric Campbell	Chair
Melanie Frye	СЕО
Gary Leidich	Director
Felicia Marcus	Director
Joe McArthur	Director
Ian McKay	Director
Shelley Longmuir	Director
Richard Woodward	Director





WECC Board of Directors Review of December 10, 2024, Closed Session

Verbal Update

Ric Campbell, Chair

December 11, 2024

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Kal Ayoub, Director of the Office of Electric Reliability

Kal Ayoub, Director of the Office of Electric Reliability, brings more than 25 years of industry and regulatory experience in electric transmission and generation engineering, cybersecurity and bulk electric system reliability to the position.

Prior to joining OER as Director, he served as Chairman Willie Phillips' Critical Infrastructure and Resilience advisor.

Ayoub joined FERC in 2009, and over the years held various positions of increasing responsibility within OER, including electrical engineer, supervisory

electrical engineer and Deputy Director of the Division of Cybersecurity. He was instrumental in advancing the Commission's regulatory initiatives to strengthen cybersecurity and physical security standards, enhance grid resilience and ensure the reliability and security of the bulk electric system.

Before joining FERC, Ayoub gained extensive private sector experience in the electric industry, holding key roles in performance engineering, power plant operations, project management and risk management. Notably, he contributed to establishing reliability and compliance programs in preparation for the nation's first mandatory reliability standards, which FERC approved in 2007.

Ayoub earned a Bachelor of Science in mechanical engineering from the University of Maryland Baltimore County.

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CEO Report

December 11, 2024

Melanie Frye President and CEO

NERC's Three-Year Planning - Regional Entity Implications

Energy	Security	Engagement	Agility and Sustainability
Renovate Reliability Assessments to create a more complete reliability risk picture associated with the transforming grid	Build E-ISAC's capabilities and reputation as an essential part of the industry security fabric	Enhance collaborative relationships/programs with stakeholders and policymakers to educate, inform, and advance strategic priorities	Shorten cycle time from BPS risk identification to standards acceptance/mitigation actions
	Ensure security is integrated into planning, design, and operation of the grid	Deliver targeted, timely, and impactful communications on NERC and E-ISAC programs and initiatives	Harmonize CMEP and RAPA frameworks across the ERO Enterprise
	Ensure integrated security program and mature security posture for NERC and ERO Enterprise		Build advanced analytical capabilities to identify and address emerging dynamic behaviors
			Leverage resources and technology to capture efficiency, lower institutional risk, and improve ERO effectiveness
Material implications	sfor		Position NERC as an "Employer of Choice" that attracts, retains, and engages top talent

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WestTEC Update

- Executed three-party contract between WECC, WPP, and Energy Strategies
- FERC approval of 2025 BP&B includes explicit support of Peak Donation reserve usage
- Project is underway, with expected timeline of September '24 to February '27
- WECC Anchor Data Set used as basis for reference case
- Draft 10-year horizon report expected June '25

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FERC, NERC, and Regional Headlines

FERC

- NERC and Regional Entity 2025 budgets approved
- First meeting of Federal-State Current Issues Collaborative focused on gas-electric coordination

NERC

- Update to five-year ERO Performance Assessment filed with proposed improvements in three areas
- Interregional Transfer Capability Study filed with FERC
- Winter Reliability Assessment published
- Long-term Reliability Assessment expected mid-December

Regional

• Day-ahead market development (EDAM, Markets+) efforts continue, and Pathways Step 2 Final Proposal completed

4

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International Updates

British Columbia

• WECC conducted three compliance audits and six guided Self-Certifications in 2024. WECC continues to work closely with the BCUC on various registration, compliance monitoring, enforcement-related activities, and provides outreach on key activities

Alberta

• WECC conducted one compliance audit in Alberta in 2024. WECC continues to work closely with the MSA on compliance monitoring and provides outreach on key activities

Mexico

• WECC continues to engage with multiple stakeholders in Mexico City and Mexicali, along with stakeholders in the U.S., in pursuit of an updated services agreement

5

• No audits were conducted in Mexico in 2024

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Metrics Legend



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METRICS

INITIATIVES

FOCUS AREA

NOT COMPLETED ON TRACK COMPLETED FA1: Innovate and expand risk-based focus in all standards, compliance monitoring, and enforcement actions 3 1 NOT ON TRACK COMPLETED COMPLETED FA2: Assess and initiate action to mitigate known and emerging risks to the reliability and security of the Western Interconnection 1 4 1 NOT ON TRACK COMPLETED COMPLETED FA3: Strengthen engagement with the reliability and security community in the Western Interconnection 3 NOT COMPLETED ON TRACK COMPLETED FA4: Seize opportunities for effectiveness, efficiency, and continuous improvements 2 1 NOT ON TRACK COMPLETED COMPLETED FA5: Build the capability and culture that enable WECC to deliver on its critical reliability mission 3



Innovate and expand risk-based focus in all standards, compliance monitoring, and enforcement actions





Assess and initiative action to mitigate known and emerging risks to the reliability and security of the Western Interconnection



Focus Area 3

Strengthen engagement with the reliability and security community in the Western Interconnection

Outcome 1: Effective relationships with industry, committee, ERP Enterprise, regulatory, policy and decision-makers, national labs and educational institutions, and the broader reliability and security community





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Initiatives



Seize opportunities for effectiveness, efficiency, and continuous improvement

Outcome 2: Continuous improvement of

changes in the industry

Outcome 1: Deliver of scorecard results, and development of methods/metrics for ongoing evaluation of effectiveness and efficiency



WECC

New WECC products focused on 1. current RRPs or emerging risks Target: 75% 50% 25% 75% 100% 0% Processes improved using 2. framework Target: 20 10 20 5 18





Build the capability and culture that enables WECC to deliver on its critical reliability mission



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Reliability and Security Oversight Update

December 10, 2024

Steven Noess Vice President, Reliability and Security Oversight



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Trends Update

- <u>Q4 update posted</u>
- What's new:
 - Quarterly highlights
 - Most-monitored risks
 - Trends observations



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Reliability & Security Workshop

- October 29-30 in Portland, Oregon
- Highlights:
 - Risk Register
 - CIP themes report
 - IBR update
 - Modifications to CIP standards
 - CIP-014 adjacency
 - Cold weather assurance
- Next workshop: March 25-27 in Phoenix, Arizona

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2024 in Numbers

- 28 compliance audits covering 352 requirements
- Three spot-checks covering four requirements
- Self-certification of 217 entities covering 981 requirements
- 24 initial and 19 refreshed Compliance Oversight Plans
- Enforcement dispositions for 255 PNCs
- Registration reviews for 25 new registered entities, 21 function changes, and 51 footprint changes

As of 11/13/2024

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Inverter-based Resources

- IBR Registration Initiative
- BA/TO Survey
- Order 901 Milestone 3
- Outreach

IBR Work Plan Milestones

✓	Phase 1: May 2023-May 2024
• •	Revise registration-related sections of ROP Seek NERC Board and FERC approval Begin outreach and education with Category 2 GO and GOP candidates
	Phase 2: May 2024-May 2025
• • •	Identify registration candidates Continue outreach and education Develop approach to establish applicable standards
	Phase 3: May 2025-May 2026
•	Complete registration activities for Category 2 GO and GOP candidates, including technology updates, training, and onboarding Notify entities of registration and compliance responsibilities

5

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Cold Weather Preparedness

- EOP-012-3
- Assurance visits
- Self-Certification



Source: FEMA

Self-Logging

- 22 active participants
- Eight applications received in 2024
- Candidate outreach and training
- ERO Enterprise harmonization



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NERC Supplemental Filing to FERC

- Proposed agility-focused process improvements in three key areas:
 - Reliability Standards development;
 - possible abeyance period for potential noncompliance and enforcement
 - Compliance Monitoring and Enforcement Program processing; and
 - More robust data collection to report on trends, themes, and recommendations.

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Member Advisory Committee Report to the WECC Board of Directors

Brian Theaker, MAC Chair

December 11, 2024

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MAC Report to the Board-December 11, 2024

Highlights

- The Member Advisory Committee (MAC) has selected its representatives for the Nominating Committee (NC), which is already beginning its work.
- The MAC chair has met with WECC and Board leadership to discuss perspectives and expectations for the coming year.

Purpose

The MAC advises the Board of Directors (Board) on any matters the Board requests the committee to evaluate or consider, and advises the Board on policy, business planning, and budgetary matters as the committee deems appropriate.

WECC Board Action Items

The MAC requests Board approval of proposed revisions to the MAC Charter. A summary of changes is included in the one-pager, along with attached clean and redline versions of the charter.

Current and Upcoming Year Goals

- Complete MAC's review of MAC communication issues.
- Complete MAC's review of its charter.
- Complete and follow the 2025 MAC work plan.
- Accomplish the bylaw-directed MAC responsibilities related to the NC and MAC Budget Subcommittee (MBS).
- Advise the Board on the Section 4.9 Review.
- Conduct and present MAC's biennial survey of Board effectiveness.
- Review WECC and other industry reports and analyses and, as appropriate, share the MAC's perspective on those reports and analyses with the Board.

Major Accomplishments and Planned Activities

1. NC and 4.9 Review

At the request of NC Chair Ian McKay's, the MAC selected its NC representatives in October to help the NC begin its work for the coming year. Those representatives are Matt Weber, Class 1 (non-voting); Tim Kelley, Class 2; Duncan Brown, Class 3; Fred Heutte, Class 4; Grace Anderson, Class 5; and Yansong Leng, International (non-voting). Chris Parker, MAC Vice Chair, will represent the MAC on the 4.9 Review group.



MAC Report to the Board-December 11, 2024

2. Meeting with WECC and Board Leadership

Brian Theaker would like to thank WECC and Board leadership for meeting with him in the months after his selection as MAC chair. He initiated meetings to share his vision for the MAC over the coming year and to invite and encourage these leaders to share their perspectives and expectations for the MAC for the coming year.

3. MAC Charter Review

The MAC will consider and adopt proposed changes to the MAC Charter at its December meeting. Thanks to Jeff Droubay and the WECC legal team for kicking off the process by preparing and circulating proposed changes to the MAC Charter in October. The proposed changes do not significantly change MAC responsibilities or processes, but clarify and adopt more precise language related to the timing and notice of meetings and various other provisions in the MAC Charter.

4. MAC Workshop

The MAC will hold its annual workshop on Wednesday, December 11, 2024. At present, the workshop will focus on (1) introductions and MAC team building and (2) WECC's 4.9 review.

5. MBS

The MAC has identified three of the members of the MBS (Dale Dunckel, Class 2; Brian Theaker, Class 3; and Sophie Hayes, Class 4). The MBS will be fully populated to support staff when staff is ready to begin the budget process.



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Member Advisory Committee

December 11, 2024

Brian Theaker MAC Chair


Member Advisory Committee

- Recent accomplishments
 - MAC representation on NC, 4.9 Review
 - Meeting with WECC and Board leadership
 - MAC Charter review
- Planned activities
 - December MAC workshop
 - Completing and launching 2025 work plan
 - Standing up and launching MBS
 - Advising the Board

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2

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Board of Directors Meeting Approval Item Member Advisory Committee Charter December 11, 2024

Board Resolution

Resolved, that the WECC Board of Directors (Board), acting on the recommendation of the Member Advisory Committee (MAC) at the meeting of the Board on December 11, 2024, approves the MAC Charter as presented and attached.

Background

A clean and redlined version of the proposed MAC Charter are included in the Board package. Initial review of the charter was performed by WECC legal and subsequent review was done by the MAC, with recommendation for Board approval expected at the December 10, 2024 MAC meeting.

Proposed revisions are as follows:

- Minor editorial changes include changing "membership" to "member," capitalization corrections, and general grammar/wording updates;
- Clarification of MAC submission of ballots;
- Correction to elections taking place "in conjunction with" instead of "at" the Annual Members meeting;
- Defining MAC leadership term start and end dates;
- Updates to meeting notice, materials posting, and approval requirements; and
- Changing the charter review requirement to "as needed but at least biennially."

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Member Advisory Committee Charter

Establishment and Authority

Member Advisory Committee

Charter

The WECC Member Advisory Committee (MAC) was established in accordance with Subsection 8.1 of the WECC Bylaws.

Purpose and Responsibilities

The purpose of the MAC is stated in Subsection 8.1 of the bylaws.

MAC responsibilities include those specified in subsections 4.9 and 8.1 of the WECC Bylaws and the following:

- Give timely updates and communications to, and get feedback from, WECC's Members on issues facing WECC to inform and influence the WECC Board of Directors (Board) in its decisions about those issues.
- Develop a work plan that includes issues identified by the Board and the MAC. Clearly communicate the work plan to the Board and the membership and implement it to ensure enough time is given to inform and influence WECC decisions.
- Work with the Board to develop and implement the agenda for the Annual Member Meeting.

MAC members have a duty to represent the interests of their member class, subclass, or international jurisdiction. All MAC members must keep regular contact with the members of their member class, subclass, or jurisdiction as issues are considered by the MAC, and must make reasonable, good-faith efforts to present and discuss both majority and minority opinions from their jurisdiction or member class on matters before the MAC.

Committee Composition and Governance

Membership

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The MAC will be composed of representative members as described in subsection 8.1.1 of the Bylaws.

Selection of Class and International Jurisdiction MAC Members

Selection of MAC members will be such that no WECC member may have more than one member representative serving as a MAC member at the same time. A MAC member may fill only one member position. Other nomination and election procedures beyond those contained in this charter may be proposed for an international jurisdiction, class, or subclass. Depending on approval by the WECC general counsel for their submission to the affected WECC members, other procedures may be implemented by majority vote of the members of an international jurisdiction, class, or subclass.

Class MAC Members

a. In conjunction with the Annual Member Meeting, each member class will elect representative class members for the MAC. Each class may divide into two or three subclasses to elect each class's MAC members. Voting for MAC members may occur in whole or in part through submission of written or electronic ballots in accordance with procedures determined by WECC's Corporate Secretary to ensure the integrity of the voting process.

b. Each WECC member class will have three MAC members. Each class MAC member will serve a three-year term. Terms must be staggered so that, in each class, only one MAC member's term ends each year.

c. A member class or subclass may establish term limits for MAC class members as determined by the electing class or subclass.

d. Each class will determine the need for diversity (regarding, for example, geographic and stakeholder issues) within that class, which may lead to the establishment of subclasses. A class may divide into two or three subclasses. Each class must establish or discontinue its subclasses, if any, by majority vote of the members in the class.

e. Only members of each class or subclass may nominate and vote on candidates for election as MAC member representatives for their respective class or subclass.

f. A class or subclass candidate need not be a member of the class or subclass, nor an employee of a class or subclass member.



g. A quorum of a majority of the members of a class or subclass must be represented to elect a MAC member for the class or subclass; election will be by simple majority of votes cast.

h. If there are more candidates for election than positions to fill, ballots will allow voters to list the candidates in order of preference so their wishes are honored in case a runoff is needed. Ballots must be counted in the first ballot based on the top choice, or the top two or three choices if more than one seat is being filled. In the event of a runoff election, ballots must be counted based on the highest preferences indicated for the candidates who remain in the runoff election.

International Jurisdiction MAC Members

a. Alberta, British Columbia, and Mexico ("international jurisdiction") must each have a representative MAC member.

b. An international jurisdiction representative MAC member will serve until removal, resignation, or a vacancy is recognized as provided in this charter.

c. Each international jurisdiction may establish, through majority vote of its WECC members, its selection processes, replacement processes, or both for its representative MAC member. An international jurisdiction may change its selection processes, replacement processes, or both by majority vote of its WECC members. Each international jurisdiction will provide to the MAC chair and WECC's corporate secretary a copy of its MAC member selection and replacement processes to the extent it establishes processes that are different from the current process, which requires each of the entities of the independent system operator operating as the Alberta Electric System Operator, for Alberta, and British Columbia Hydro and Power Authority, for British Columbia to designate a MAC member shave established their selection and replacement processes, these international jurisdictions will continue to have representative MAC members selected by the independent system operator operating as Alberta Electric System Operator for Alberta, and British Columbia Hydro and Power Authority for British Columbia WECC members have established their selection and replacement processes, these international jurisdictions will continue to have representative MAC members selected by the independent system operator operating as Alberta Electric System Operator for Alberta, and British Columbia Hydro and Power Authority for British Columbia.

d. Having an international jurisdiction MAC member for each international jurisdiction does not restrict WECC members from Alberta, British Columbia, or Mexico from participating in the activities of their WECC member classes or subclasses, including taking part in their class or subclass MAC member elections. However, no international jurisdiction representative may



be employed by a WECC member that also employs a MAC member class or subclass representative.

Member Vacancy by Resignation, Removal, or Nonparticipation

Any MAC member may resign from their position at any time by giving written notice to the MAC chair. This notice is effective on the date it is given to the MAC chair. A MAC member's nonparticipation in MAC meetings for a period of four consecutive meetings may be considered a vacancy. The MAC chair will decide whether to recognize a vacancy due to nonparticipation.

2. The MAC, the international jurisdiction, a member class, or a subclass may remove a MAC member before completion of the MAC member's term of office as follows:

a. The MAC may remove any MAC member for gross negligence; gross misconduct; violation of local, state, provincial, or federal law; or gross failure to carry out the duties of a MAC member. Removal will only occur after the affirmative vote of at least two-thirds of the MAC members.

b. A majority of members from any international jurisdiction, class, or subclass may remove one of their MAC members by submitting in writing their request to the MAC chair and WECC's chief executive officer.

The MAC member's position will be deemed vacant and the vacancy filled according to Section 2c below.

c. In keeping with Selection of Class and International Jurisdiction MAC Members, Section 2b, members from an international jurisdiction may establish a different process from that provided in Section 3 below to address resignation, removal, nonparticipation, or vacancy, but such process will not infringe on the ability of a majority of members from that international jurisdiction to remove their MAC member representative.

3. Whenever a MAC vacancy occurs, the MAC chair will:

a. Consult with the members of the affected international jurisdiction, class, or subclass for the appointment of an interim MAC member to fill the vacancy as may be required to meet the MAC quorum requirements. The appointee will serve until an election or the process as established by the international jurisdiction members selects a replacement for the rest of the



vacated term. Any interim appointment must come from members of the same international jurisdiction, class, or subclass from which the vacancy arose.

b. Promptly conduct a special election for the class, subclass, or international jurisdiction—as applicable—from which the vacancy arose, allowing a reasonable period to select candidates and to organize such an election.

c. If a special election chooses a replacement class or subclass MAC member no more than 14 months before the end of the vacated term filled by the special election, the MAC member chosen by the special election will fill the rest of the vacated term and the following regular three-year term as the MAC member representative for the electing class or subclass.

Leadership

The MAC chair will manage the committee and its meetings.

The MAC vice chair will perform the duties of the MAC chair in the chair's absence or in case of a vacancy in the office of the chair.

During a MAC meeting conducting official business, each MAC member represents one vote while present in person as defined in Meetings, Section 7 of the WECC Bylaws.

In conjunction with the Annual Member Meeting, after incoming MAC members are duly elected, the MAC will elect the MAC chair and MAC vice chair from the MAC members following the guidelines in the "Process for Selecting MAC Leadership." The chair and vice chair must be from different classes; must be from different WECC members; and both must not be from related WECC member affiliates (as that relationship is defined in Subsection 4.5 of the WECC Bylaws). The MAC chair and vice chair will serve one-year terms, measured from the close of the Annual Member Meeting to the close of the next Annual Member Meeting. In the event the chair or vice chair resigns or is removed, the MAC members will, at their next regular or special meeting, whichever is sooner, elect a new MAC chair or MAC vice chair to serve during the rest of the vacated term.

An international jurisdiction MAC member may serve as chair or vice chair if the class association of the international jurisdiction MAC member applies to class and affiliate representation restrictions in Leadership, Section 4.

WECC staff performs the administrative duties for the MAC, including preparing meeting minutes for MAC approval.



Meetings

All regular business must occur at duly noticed meetings. The MAC will meet in person or via teleconference or telephone not less than two times per year, including once in conjunction with the Annual Member Meeting.

a. The MAC will establish a written regular meeting schedule, which includes time and venue, and is available to WECC members, Directors, and the public through posting on the WECC website.

b. Email notice of the time and place of all meetings will be provided to each member of the MAC and to WECC's Board, no later than 10 days before the meeting, or upon as much notice as is reasonable under the circumstances as approved by a majority of MAC members. An agenda, including identification of the items for which action may be taken, will be provided with the meeting notice. Notice of meetings and the agenda will also be posted on the WECC website. Approval item documents should also be posted in advance of the meeting, when possible, but documents approved by the MAC may differ from what is posted.

2. Meetings and associated agendas should be designed to prioritize discussion of timely matters relevant to the reliability and security of the Western Interconnection, including recent, ongoing, and forthcoming studies or analyses.

a. Background information on major issues will be issued with enough advance notice to allow review and discussion by the MAC and, where appropriate, engagement with the membership.

b. The MAC will prioritize discussion about member views on major issues to ensure membership concerns are properly heard by the MAC and to support the MAC's responsibility to inform and influence the Board.

c. Administrative concerns shall be addressed efficiently to prioritize discussion of major issues.

4 Whenever the MAC chair finds (or upon request to the MAC chair from any five MAC members) that there is urgent business needing MAC consideration or action before the next regularly scheduled meeting, a special meeting will be called within at least three-business-days' notice to all MAC members and WECC Directors, which notice may be by email or similar. WECC website posting of the notice for the meeting with required and supporting documents will occur at least one business day before the special meeting.



5 A MAC quorum must be established before official business can be conducted. Quorum must be a majority of MAC members being present, including at least one MAC member from each member class and one international jurisdiction MAC member, not including subclass designations.

6 A meeting failing quorum may proceed with general discussion and status reports. However, the chair must postpone any agenda items proposed for approval. Official business may begin at any time upon achieving quorum.

7 A decision of the MAC must be by a simple majority vote of those committee members present in person unless otherwise required in this charter or the Bylaws.

8 All MAC members may participate in any meeting of the MAC, including casting votes, by teleconference or by telephone, or by any other means that enables simultaneous discussion. Every MAC member participating in a meeting in this way will be deemed present in person at the meeting.

9 Except as provided elsewhere in this charter, all regular and special meetings of the MAC will be open to observation by any WECC member, Director, or any member of the public.

10 If a quorum exists at a meeting, a MAC open meeting may close and reconvene in closed session after an affirmative vote of two-thirds of the MAC members present in the following instances:

a. To receive and discuss confidential attorney-client-privileged information from WECC's counsel; or

b. To receive and discuss any other information that is privileged, confidential, proprietary, trade secret, or protected from public disclosure by law.

11 Closed sessions of the MAC may not be attended by a MAC member under the following circumstances:

a. When the qualification or performance of the MAC member is being discussed;

b. When the MAC member is employed by an entity that is or is likely to become a party to the litigation or legal issue being discussed; or



c. When the MAC chair determines that the MAC member would have a conflict of interest by becoming privy to the privileged or confidential information that is to be presented to or discussed by the MAC in closed session.

Any member of the Board may attend a closed session of the MAC unless the topic considered by the MAC concerns the Director.

Before adjourning to a closed session, the MAC chair will announce the purpose of the closed session in a way that gives the public an understanding of the general subject matter to be discussed, but that does not reveal privileged, confidential, or sensitive personal information. The closed session will be limited in scope to the publicly stated purpose of the closed session. After the closed session has ended, the MAC chair will give the public a general description of the business conducted during the closed session without breaching the confidentiality of the information used in the session.

All MAC members and any others present at a closed session must maintain the confidentiality of the information, discussions, and decisions made in closed session. Unless otherwise required, all MAC members and closed-session attendees must complete a confidentiality agreement provided by WECC's general counsel. The MAC chair must appoint a secretary for the closed session to take minutes of the closed session, which will be delivered to the WECC corporate secretary. The corporate secretary or delegate will keep minutes of the closed session confidential.

MAC member activities will be self-funded by WECC members with respect to labor and travel expenses unless otherwise provided by policy or the Bylaws.

Electronic Voting

The Chair may initiate an electronic vote for the MAC if:

a. The issue has been discussed at least once in a MAC meeting.

b. The resolution to be voted on is drafted as a "yes-or-no" vote.

WECC staff will conduct the electronic vote as follows:

a. Notify all MAC members, by email, at least seven calendar days before the vote will be taken with the resolution to be voted on, all relevant background documents, and the timeline for the vote.



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MAC Charter

b. Upon objection of five or more MAC members within seven calendar days of the notice, the electronic vote will not be conducted.

c. Allow at least three business days for MAC members to vote.

d. Send one reminder, if necessary, to try to reach a quorum in the vote.

The requirements for quorum must be met for the vote to be valid.

MAC Subcommittees, Work Groups, and Liaisons

The MAC may create, by majority vote, subcommittees and work groups as necessary to carry out its business affairs. The MAC chair may appoint one or more MAC members or other people to participate in MAC subcommittees or work groups as full voting members or as non-voting advisory members.

Subcommittees will have no definite disbandment requirement and will address recurring business affairs that need MAC action. The MAC will approve a charter defining the scope and purpose of any such subcommittee and other instruction that the MAC sees fit.

Work groups of the MAC disband after completing assigned specific tasks as documented in the MAC meeting minutes.

Subcommittee and work group meetings will be open to observation by any WECC member, Director, or member of the public, with the following limitations:

a. Meeting schedules will be posted on the WECC website with as much notice as practical.

b. Any public participation will be decided by the subcommittee or work group chair.

c. The ability of a MAC subcommittee to meet in closed session must be established in advance and contained in the charter approved by the MAC. The subcommittee charter will mandate that each closed meeting be approved in advance by the MAC. All closed meetings will follow charter requirements for a closed meeting.

d. The ability of a MAC work group to meet in closed session will be established by resolution in advance during a MAC meeting. The resolution will require the meeting to follow charter requirements for a closed meeting.

The MAC chair will appoint MAC member liaisons to other committees and liaisons will perform the duties described in the "MAC Liaisons to Other WECC Committees" document.



https://www.wecc.org/Corporate/Role%20of%20a%20MAC%20Liaison%20to%20another%20C ommittee.pdf

Nominating Committee

The MAC will select four voting, and two non-voting liaison members for the Nominating Committee following Section 6.4.1 of the bylaws and these provisions:

a. Each member class and the international jurisdiction MAC members will elect their respective Nominating Committee members. The MAC chair will notify the Board chair of the selections.

b. MAC members of the Nominating Committee must not be from the same member class.

c. Among Classes 1, 2, and 3, the class represented on the Nominating Committee as a nonvoting liaison will rotate each year in numerical order, repeating at Class 1 following Class 3.

Reporting

The MAC will report to the Board as described in Section 8.1.2 of the WECC Bylaws.

The MAC chair or designee will attend the Board's meetings to provide advice, clarification, or responses to Directors' questions. The Board and MAC chairs will develop guiding principles and procedures as necessary to ensure open, effective, and efficient dialogue between the MAC and Board. The Board and MAC chairs may amend those guiding principles and procedures.

Review and Changes to the Charter

The MAC will review this charter as needed but at least biennially and recommend any changes to the Board.

Approved by the WECC Board of Directors: December 6, 2023



10

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Member Advisory Committee Charter

-Establishment and Authority

Member Advisory Committee

Charter

The WECC Member Advisory Committee (MAC) was established in accordance with Subsection 8.1 of the WECC Bylaws.

Purpose and Responsibilities

The purpose of the MAC is stated in Subsection 8.1 of the bylaws.

MAC responsibilities include those specified in <u>Subsections subsections</u> 4.9 and 8.1 of the WECC Bylaws and the following:

- Give timely updates and communications to, and get feedback from, the WECC's
 membership Members on issues facing WECC to inform and influence the WECC Board of Directors (Board) in its decisions about those issues.
- Develop a work plan that includes issues identified by the Board and the MAC. Clearly communicate the work plan to the Board and the membership and implement it to ensure enough time is given to inform and influence WECC decisions.
- Work with the Board to develop and implement the agenda for the Annual Member Meeting.

MAC members have a duty to represent the interests of their member class, subclass, or international jurisdiction. All MAC members must keep regular contact with the members of their member class, subclass, or jurisdiction as issues are considered by the MAC, and must make reasonable, good-faith efforts to present and discuss both majority and minority opinions from their jurisdiction or member class on matters before the MAC.

Committee Composition and Governance

Membership

155 North 400 West | Suite 200 | Salt Lake City, Utah 84103 www.wecc.org **Formatted:** List Paragraph, Bulleted + Level: 1 + Aligned at: 0.25" + Indent at: 0.5"

MAC Charter

The MAC will be composed of representative members as described in <u>Part subsection</u> 8.1.1 of the <u>B</u>bylaws.

Selection of Class and International Jurisdiction MAC Members

Selection of MAC members will be such that no WECC member may have more than one member representative serving as a MAC member at the same time. A MAC member may fill only one member position. Other nomination and election procedures beyond those contained in this charter may be proposed for an international jurisdiction, class, or subclass. Depending on approval by the WECC general counsel for their submission to the affected WECC members, other procedures may be implemented by majority vote of the members of an international jurisdiction, class, or subclass.

Class MAC Members

a. At-In conjunction with the Annual Member Meeting, each member class will elect representative class members for the MAC. Each class may divide into two or three subclasses to elect each class's MAC members. <u>Voting for MAC members may occur in whole or in part</u> through submission of written or electronic ballots in accordance with procedures determined by WECC's Corporate Secretary to ensure the integrity of the voting process.

b. Each WECC member class will have three MAC members. Each class MAC member will serve a three-year term. Terms must be staggered so that, in each class, only one MAC member's term ends each year.

c. A member class or subclass may establish term limits for MAC class members as determined by the electing class or subclass.

d. Each class will determine the need for diversity (regarding, for example, geographic and stakeholder issues) within that class, which may lead to the establishment of subclasses. A class may divide into two or three subclasses. Each class must establish or discontinue its subclasses, if any, by majority vote of the members in the class.

e. Only members of each class or subclass may nominate and vote on candidates for election as MAC member representatives for their respective class or subclass.

f. A class or subclass candidate need not be a member of the class or subclass, nor an employee of a class or subclass member.



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MAC Charter

g. A quorum of a majority of the members of a class or subclass must be represented to elect a MAC member for the class or subclass; election will be by simple majority of votes cast.

h. If there are more candidates for election than positions to fill, ballots will allow voters to list the candidates in order of preference so their wishes <u>may beare</u> honored in case a runoff is needed. Ballots must be counted in the first ballot based on the top choice, or the top two or three choices₇ if more than one seat is being filled. <u>In anyIn the event of a</u> runoff election, ballots must be counted based on the highest preferences indicated for the candidates who remain in the runoff election.

a. Alberta, British Columbia, and Mexico ("international jurisdiction") must each have a representative MAC member.

b. An international jurisdiction representative MAC member will serve until removal, resignation, or a vacancy is recognized as provided in this charter.

c. Each international jurisdiction may establish, through majority vote of its WECC members, its selection processes, replacement processes, or both for its representative MAC member. An international jurisdiction may change its selection processes, replacement processes, or both by majority vote of its WECC members. Each international jurisdiction will provide to the MAC chair and WECC's corporate secretary a copy of its MAC member selection and replacement processes to the extent it establishes processes that are different from the current process₂ which that requires each of the entities of the independent system operator operating as the Alberta Electric System Operator, for Alberta, and British Columbia Hydro and Power Authority, for British Columbia to designate a MAC member from their respective organizations. Until Alberta and British Columbia WECC members have established their selection and replacement processes, these international jurisdictions will continue to have representative MAC members selected by the independent system operator operating as Alberta Electric System Operator for Alberta, and British Columbia Hydro and Power Authority for British Columbias to design at a majority weight of the selection share established their selection and replacement processes, these international jurisdictions will continue to have representative MAC members selected by the independent system operator operating as Alberta Electric System Operator for Alberta, and British Columbia Hydro and Power Authority for British Columbia.

d. Having an international jurisdiction MAC member for each international jurisdiction does not restrict WECC members from Alberta, British Columbia, or Mexico from participating in the activities of their WECC member classes or subclasses, including taking part in their class or subclass MAC member elections. However, no international jurisdiction representative may

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MAC Charter

4

be employed by a WECC member that also employs a MAC member class or subclass representative.

Member Vacancy by Resignation, Removal, or Nonparticipation

Any MAC member may resign from their position at any time by giving written notice to the MAC chair. This notice is effective on the date it is given to the MAC chair. A MAC member's nonparticipation in MAC meetings for a period of four consecutive meetings may be considered a vacancy. The MAC chair will decide whether to recognize a vacancy due to nonparticipation.

2. The MAC, <u>the</u> international jurisdiction, <u>a</u> member class, or <u>a</u> subclass may remove a MAC member before completion of the MAC member's term of office as follows:

a. The MAC may remove any MAC member for gross negligence; gross misconduct; violation of local, state, provincial, or federal law; or gross failure to carry out the duties of a MAC member. Removal will only occur after the affirmative vote of at least two-thirds of the MAC members.

b. A majority of members from any international jurisdiction, class, or subclass may remove one of their MAC members by submitting in writing their request to the MAC chair and WECC's chief executive officer.

c. In keeping with Selection of Class and International Jurisdiction MAC Members, Section 2b, members from an international jurisdiction may establish a different process from that provided in Section 3 below to address resignation, removal, nonparticipation, or vacancy, but such process will not infringe on the ability of a majority of members from that international jurisdiction to remove their MAC member representative.

a. Consult with the members of the affected international jurisdiction, class, or subclass for the appointment of an interim MAC member to fill the vacancy as may be required to meet the MAC quorum requirements. The appointee will serve until an election or the process as established by the international jurisdiction members selects a replacement for the rest of the vacated term. Any interim appointment must come from members of the same international jurisdiction, class, or subclass from which the vacancy arose.



MAC Charter

b. Promptly conduct a special election for the class, subclass, or international jurisdiction—as applicable—from which the vacancy arose, allowing a reasonable period to select candidates and to organize such an election.

c. If a special election chooses a replacement class or subclass MAC member no more than 14 months before the end of the vacated term filled by the special election, the MAC member chosen by the special election will fill the rest of the vacated term and the following regular three-year term as the MAC member representative for the electing class or subclass.

Leadership

The MAC chair will manage the committee and its meetings.

The MAC vice chair will perform the duties of the MAC chair in the chair's absence or in case of a vacancy in the office of the chair.

During a MAC meeting conducting official business, each MAC member represents one vote while present in person as defined in Meetings, Section 7 of the WECC Bylaws.

At In conjunction with the Annual Member Meeting, after incoming MAC members are duly elected, the MAC will elect the MAC chair and MAC vice chair from the MAC members following the guidelines in the "Process for Selecting MAC Leadership." The chair and vice chair must be from different classes; must be from different WECC members; and both must not be from related WECC member affiliates (as that relationship is <u>used_defined</u> in Subsection 4.5 of the WECC Bylaws). The MAC chair and vice chair will serve one-year terms, measured from the <u>close of the</u> Annual Member Meeting to the <u>close of the</u> next Annual Member Meeting. In <u>case-the event</u> the chair or vice chair resigns or is removed, the MAC members will, at their next regular or special meeting, whichever is sooner, elect a new MAC chair or MAC vice chair to serve during the rest of the <u>vacated</u> term.

An international jurisdiction MAC member may serve as chair or vice chair if the class association of the international jurisdiction MAC member applies to class and affiliate representation restrictions in Leadership, Section 4.

WECC staff performs the secretarial-administrative duties for the MAC, including preparing meeting minutes for MAC approval.

Meetings



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MAC Charter

6

All regular business must occur at duly noticed meetings. The MAC will meet in person <u>or via</u> <u>teleconference or telephone</u> not less than two times per year, including once in conjunction with the Annual Member Meeting.

a. The MAC will establish a written regular meeting schedule, which: <u>i. I</u>ncludes time and venue, <u>and</u>

a. Background information on major issues will be issued with enough advance notice to allow review and discussion by the MAC and, where appropriate, engagement with the membership.

b. The MAC shall-will prioritize discussion about member views on major issues to ensure membership concerns are properly heard by the MAC and to support the MAC's responsibility to inform and influence the Board.

c. Administrative concerns shall be addressed efficiently to prioritize discussion of major issues.

5 A MAC quorum must be established before official business can be conducted. Quorum must be a majority of MAC members being present, including at least one MAC member from each member class and one international jurisdiction MAC member, not including subclass designations.

6 A meeting failing quorum may proceed with general discussion and status reports. However, the chair must postpone any agenda items proposed for approval. Official business may begin at any time upon achieving quorum.

7 A decision of the MAC must be by a simple majority vote of those committee members present in person unless otherwise required in this charter or the Bylaws.

8 All MAC members may participate in any meeting of the MAC<u>, including casting votes</u>, electronically by teleconference or by telephone, or by any other means that enables simultaneous discussion. Every MAC member participating in a meeting in this way will be deemed present in person at the meeting.



MAC Charter

7

9 Except as provided elsewhere in this charter, all regular and special meetings of the MAC will be open to observation by any WECC member, Director, or any member of the public.

10 If a quorum exists at a meeting, a MAC open meeting may close and reconvene in closed session after an affirmative vote of two-thirds of the MAC members present in the following instances:

a. To receive and discuss confidential attorney-client-privileged information from WECC's counsel; or

b. To receive and discuss any other information that is privileged, confidential, proprietary, trade secret, or protected from public disclosure by law.

11 Closed sessions of the MAC may not be attended by a MAC member under the following circumstances:

a. When the qualification or performance of the MAC member is being discussed;

b. When the MAC member is employed by an entity that is or is likely to become a party to the litigation or legal issue being discussed; or

c. When the MAC chair determines that the MAC member would have a conflict of interest by becoming privy to the privileged or confidential information that is to be presented to or discussed by the MAC in closed session.

Any member of the Board may attend a closed session of the MAC unless the topic considered by the MAC concerns the Director.

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MAC Charter

8

a secretary for the closed session to take minutes of the closed session, which will be delivered to the WECC corporate secretary. The corporate secretary or delegate will keep minutes of the closed session confidential.

MAC member activities will be self-funded by WECC members with respect to labor and travel expenses unless otherwise provided by policy or the Bylaws.

Electronic Voting

The Chair may initiate an electronic vote for the MAC if:

a. The issue has been discussed at least once in a MAC meeting.

b. The resolution to be voted on is drafted as a "yes-or-no" vote.

WECC staff will conduct the electronic vote as follows:

a. Notify all MAC members, by email-or similar, at least seven calendar days before the vote will be taken with the resolution to be voted on, all relevant background documents, and the timeline for the vote.

b. Upon objection of five or more MAC members within seven calendar days of the notice, the electronic vote will not be conducted.

c. Allow at least three business days for MAC members to vote.

d. Send one reminder, if necessary, to try to reach a quorum in the vote.

The requirements for quorum must be met for the vote to be valid.

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Work groups of the MAC disband after completing assigned specific tasks as documented in the MAC meeting minutes.



MAC Charter

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ExeptasprovidedirSection643cffhebylawsalkSubcommitteeandworkgroupmeetingswillbeepentoebervationbyaryWBCCmember, Director, or member of the public, with the following limitations:

a. Meeting schedules will be posted on the WECC website with as much notice as practical.

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Nominating Committee

The MAC will select four voting, and two non-voting liaison members for the Nominating Committee following Section 6.4.1 of the bylaws and these provisions:

a. Each member class and the international jurisdiction MAC members will elect their respective Nominating Committee members. The MAC chair will notify the Board chair of the selections.

b. MAC members of the Nominating Committee must not be from the same member class.

c. Among Classes 1, 2, and 3, the class represented on the Nominating Committee as a nonvoting liaison will rotate each year in numerical order, repeating at Class 1 following Class 3.

Reporting

The MAC will report to the Board as described in Section 8.1.2 of the WECC Bylaws.

The MAC chair or designee will attend the Board's meetings to provide advice, clarification, or responses to Directors' questions. The Board and MAC chairs will develop guiding principles



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MAC Charter

and procedures as necessary to ensure open, effective, and efficient dialogue between the MAC and Board. The Board and MAC chairs may amend those guiding principles and procedures.

Review and Changes to the Charter

The MAC will review this charter annually as needed but at least biennially and recommend any changes to the Board.

Approved by the WECC Board of Directors: December 6, 2023



WIRAB Advice to WECC On the Draft Long Term Strategy

November 15, 2024

Introduction:

The Western Interconnection Regional Advisory Body (WIRAB) appreciates the opportunity to submit Advice to WECC on the Draft Long-Term Strategy.

Background:

WECC is revising its Long-Term Strategy to reflect evolving challenges in the Western Interconnection, while aligning with the ERO Enterprise Long Term Strategy and expanding on it for critical matters that are unique and important in the West.

Lea Marquez Peterson Vice Chair

Laura Rennick Executive Director **ERO Enterprise Long-Term Strategy:** The ERO Enterprise represents the collective mission of NERC and its six Regional Entities, including WECC. A year-long refresh of the ERO Enterprise Long-Term Strategy has taken place, with input from various

stakeholders, including WECC. In September, the WECC Board endorsed the draft strategy, and further action by the NERC Board of Trustees is expected in December.

WECC's Long Term Strategy Feedback: At its Annual Members Meeting, WECC solicited feedback on its draft Long-Term Strategy. WIRAB Leadership participated in that session along with other WECC members and the WECC Board of Directors. WECC received valuable feedback, particularly on the tone, descriptions, and alignment with WECC's mission and vision.

General Feedback:

Draft 2 of the WECC Long-Term Strategy reflects significant progress in aligning with WECC's mission and vision. WECC's efforts to frame the strategy around its core "why" are well-articulated, showing the emphasis on reliability in an evolving energy landscape. Furthermore, the holistic risk-based approach, combined with a focus on interconnection-wide perspectives, shows a strong commitment to addressing the region's unique challenges.

Notable Improvements from Draft 1 to Draft 2:

 Expanded Description of WECC's Why: WECC describes itself as *The Independent Voice of Bulk Power System Reliability in the Western Interconnection*, a significant improvement from *The Voice of Reliability in the West* touted in Draft 1. This description highlights WECC's crucial role while staying balanced and not overstating its influence. Additionally, WECC added in an important description of the Western Interconnection, helping connect its role and overseeing an

Arizona Baja California British Columbia California Colorado Idaho Montana Nebraska Nevada New Mexico Oregon South Dakota Texas Utah Washington

Wyoming

Mary Throne Chair

Alberta

WIRAB Advice to WECC On the Draft Long Term Strategy November 15, 2024

energy system that supports essential services for communities, public safety, and economic growth.

- Updated Forward Looking Tone: Throughout the document, WECC improved the tone of the document by using statements like "we will" and using actionable language that give the document forward looking strategic tone, contrasting with the past-accomplishment tone of Draft 1. The goal of the Long-Term Strategy is to build on successes, but to continue to advance because past success does not necessarily mean future improvement.
- 3. Enhanced Stakeholder Collaboration: Draft 2 improved upon the importance of partnership, particularly in addressing evolving risks. The recognition that WECC has a unique role as a reliability regulator but also a subject matter expert, it requires collaboration, with stakeholders including utilities, state and regional partners, and others to proactively address reliability risks.
- 4. **Improved Independence Description**: A key improvement in Draft 2 is the expanded explanation of WECC's Independence in Impact Area 4. WECC understands that its role is to inform decision-makers and to meet them where they are when it comes to understanding the impacts policy and business decisions have on the reliability of the grid. WECC expanded its description to emphasize that it will produce work products tailored to different audiences to improve their effectiveness. This focus enhances trust in WECC's impartiality.

Areas for Further Improvement:

- Emphasize Social Welfare Status: WECC mentions that it is a non-profit with delegated authority to perform reliability functions, but WECC's status as a 501(c)(4) social welfare organization should be more prominently mentioned to reinforce its role in serving the broader stakeholder community, not individual interests. This would support WECC's focus on maintaining neutrality in its role as a reliability organization without being swayed by business, political or policy agendas of individual companies, groups, governmental entities or personal interests.
- 2. Create a Celebrated Workforce Culture: Draft 2 could benefit from a more detailed description of how WECC plans to embed continuous improvement in its organizational culture. WECC does an excellent job emphasizing that it is important to "trust each other" and "empower" employees. One important aspect of workplace culture is acknowledging and celebrating accomplishments and understanding the impact. WECC should consider explicitly adding a goal to celebrate accomplishments to continuously improve workplace culture.

Conclusion:

The WECC Long-Term Strategy is a comprehensive effort that aligns with WECC's mission and vision while addressing unique challenges in the Western Interconnection. The improvements in Draft 2—especially in tone, stakeholder collaboration, and independence—show significant progress. Moving forward, emphasizing WECC's social welfare role and celebrating accomplishments will further enhance the strategy's effectiveness in achieving an organization that can enhance the long-term reliability and security for the grid.



Date: November 22, 2024

To: WECC Board of Directors

From: Western Interconnection Regional Advisory Body (WIRAB)

Subject: WIRAB's Technical Report: "Inverter-Based Resource Risk Assessment -Recommendations for Regulatory Bodies to Support Risk Mitigations During the Energy Transition"

Dear Members of the WECC Board of Directors,

The Western Interconnection Regional Advisory Body (WIRAB) is pleased to submit the attached report, Inverter-Based Resource Risk Assessment: Recommendations for Regulatory Bodies to Support Risk Mitigations During the Energy Transition in the Western Interconnection. This report reflects the culmination of comprehensive research and analysis commissioned by WIRAB in response to the rapidly evolving resource mix and its implications for grid reliability and security.

Purpose of the Report

The Western Interconnection is experiencing a profound shift in its energy landscape, characterized by a rapid increase in inverter-based resources (IBRs) such as wind, solar photovoltaic (PV), and battery energy storage systems (BESS). While these resources present significant opportunities for a less carbon intensive electric grid, they also introduce unique technical and operational challenges that can impact bulk power system reliability. WIRAB commissioned the report to identify critical gaps and propose actionable recommendations to ensure a reliable, resilient, and secure energy transition.

Why This Report is Important

- 1. Timely Insights on Emerging Risks: The report provides an in-depth assessment of risks associated with IBR integration, including interconnection challenges, modeling inadequacies, and operational complexities. It underscores the urgency for proactive measures to address these risks, while outlining the work currently being done to address these risks.
- 2. Strategic Recommendations: The report outlines near-term, medium-term, and long-term recommendations tailored to key stakeholders, including WECC. These include enhancing interconnection requirements, fostering regional collaboration, exploring advanced grid technologies such as grid-forming inverters, and a new regulatory scheme to proactively address IBR-related risks. It also provides actions that state utility commissioners can do to aid in the mitigation efforts.
- 3. Alignment with WECC's Mission and Strategy: The report's recommendations complement WECC's ongoing efforts to address IBRs as a Reliability Risk Priority and aligns with its mission to ensure the reliability and security of the Western Interconnection.

Alberta Arizona Baja California British Columbia California Colorado Idaho Montana Nebraska Nevada New Mexico Oregon South Dakota Texas Utah Washington Wyoming

Mary Throne Chair

Lea Márquez Peterson Vice Chair

Laura Rennick Executive Director

Key Takeaways for WECC

- Enhanced Interconnection Standards: Recommendations emphasize adopting and harmonizing with the IEEE 2800-2022 standards across the region to mitigate IBR risks effectively.
- **Stakeholder Collaboration**: WECC's role as a neutral coordinator is highlighted, particularly in engaging state regulators, utilities, and industry stakeholders to address regional reliability challenges.
- Focus on Proactive Measures: The report advocates for pilot projects, education programs, improved modeling practices, and other efforts to stay ahead of emerging risks.

Looking Ahead

WIRAB looks forward to collaborating with WECC to prioritize and implement the recommendations outlined in this report. By working together, we can ensure that the Western Interconnection not only adapts to the energy transition but leads it in a way that preserves reliability and resilience.

We welcome the opportunity to discuss the findings and recommendations in greater detail and to explore specific actions WECC can take to address the challenges and opportunities identified in the report.

Thank you for your continued partnership and commitment to grid reliability.

Sincerely, /s/ Mary Throne Chair, Western Interconnection Regional Advisory Body (WIRAB) Chairman, Wyoming Public Service Commission

/s/ Lea Márquez Peterson Vice Chair, Western Interconnection Regional Advisory Body (WIRAB) Commissioner, Arizona Corporation Commission

/s/ Laura Rennick Executive Director, Western Interstate Energy Board



Inverter-Based Resource Risk Assessment

Recommendations for Regulatory Bodies to Support Risk Mitigations for Inverter-based Resources during the Energy Transition in the Western Interconnection

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EXECUTIVE SUMMARY

The generation resource mix across the Western Interconnection continues to rapidly transition to increasing levels of renewable energy resources, predominantly inverter-based resource (IBR) technologies such as wind, solar photovoltaic (PV), battery energy storage (BESS), and hybrid plants consisting of multiple of these technologies. This rapid change presents unique opportunities and challenges for ensuring bulk power system (BPS) reliability and resilience. IBRs are introducing new and emerging BPS reliability risks that must be managed by the electricity sector in an effective, efficient, and agile manner. Past large-scale grid disturbances in California, Utah, Texas, North America and globally have highlighted systemic risk issues that need to be addressed by an array of stakeholders – ranging from regulatory bodies and policymakers to transmission providers and generator developer/owner/operators to associated original equipment manufacturers (OEM) and service providers.

Figure ES.1 illustrates a core set of systems integration challenges that are likely to emerge as IBR penetration levels rise. As this report highlights, the Western Interconnection has a relatively higher IBR penetration level than many other parts of North America today and those levels are expected to rise rather quickly. However, each utility likely has a different level of capabilities and experience with IBR integration based on their past IBR growth and future projections. Therefore, which of the issues outlined in Figure ES.1 may differ by system and entity; however, entities are likely to face each of these challenges or risks as their own system experiences increasing levels of IBRs moving forward. Therefore, it is important to develop and implement mitigating measures effectively and proactively. These mitigation measures will need to be implemented by appropriate stakeholders to address these challenges in the years ahead. However, it should be highlighted that the pace of change the electricity sector is experiencing necessitates swift and effective action in this area.



Figure ES.1. IBR Systems Integration Risks and Challenges



The Western Interconnection Regional Advisory Body (WIRAB) advises the Federal Energy Regulatory Commission (FERC), North American Electric Reliability Corporation (NERC), and Western Electricity Coordinating Council (WECC) on matters pertaining to electric reliability in the Western Interconnection which may involve proposed reliability standards, key risk priorities, and other topics that are in the West's economic and societal benefits.

This assessment highlights grid reliability challenges that need to be addressed as industry collectively works through the energy transition and provides evidence that immediate attention is needed to address the foundational aspects of a reliable BPS from different angles and from a diverse set of stakeholders. This work culminates in the following near-term, medium-term, and long-term recommendations where WECC and its members, transmission providers (e.g., TOs, ISO/RTOs, etc.), WIRAB and its members, and State utility commissions are all key stakeholders for these recommendations (see **CHAPTER 4:** *Key Findings and Recommendations*):

- Near-Term (1–2 Years) Recommendations
 - Template Facility Interconnection Requirements (WECC)
 - Targeted Stakeholder Engagement on Emerging IBR Topics (WECC)
 - IBR Interconnection Challenges, grid forming training and needs, EMT modeling and studies, integrated resource planning, flexibility metrics and energy assurance, etc.
 - Harmonized Adoption of IBR Requirements (NERC/FERC)
 - State Regulatory Emphasis of IBR Requirements Enhancements (State PUCs)
- Medium Term (3–4 Years) Recommendations
 - Proactive Stakeholder-Engaged Risk Mitigation (WECC)
 - Pilot Projects for Emerging IBR Risk Mitigations (WECC)
 - o Regional Reliability Standard for Unified IBR Requirements (WECC)
- Long-Term (2030+) Recommendations
 - o Transitioning Toward a Grid Code Approach in the West

State utility commissioners also can help play a pivotal role in driving meaningful enhancements in addressing these energy transition risks. Recommendations for how State commissioners can engage in this discussion include (again, see **CHAPTER 4**: *Key Findings and Recommendations* for more details):

- Advocate for Enhanced and Harmonized Transmission Owner Interconnection Requirements:
 - Inquire About and Support Adoption of IEEE 2800-2022
- Promote Coordination Between State and Federal Authorities
- Encourage and Support Utility Investment in Grid Modernization
- Support Streamlining of Interconnection Processes
- Stay Informed on Active Industry Efforts in This Area

These actions can help state utility commissioners play a proactive role in enhancing interconnection requirements and contributing to a more reliable and resilient bulk power system.



Table of Contents

EXECUTIVE SUMMARY
LIST OF ACRONYMS
INTRODUCTION
Background and Scope7
Growth of IBRs Across the West8
IBR Risk Assessment Process10
CHAPTER 1: Prioritized List of IBR Risks in the West
Observations and Indicators of IBR Performance Risks11
NERC Disturbance Reports
2016 South Australia Blackout12
2019 United Kingdom Load Shedding Event12
2021 and 2022 Odessa Disturbances in Texas12
Systems Integration Challenges with Growing IBRs13
Prioritizing IBR Systems Integration Challenges14
CHAPTER 2: Current Industry Risk Mitigation Activities16
FERC Orders and Directives16
FERC Order 2023
NERC IBR Registration Initiative17
NERC Standards Developments for Order 90117
NERC IRPS Activities
Other NERC Activities
WECC Studies of IBR Risks
Industry Efforts to Manage IBR Risks
IEEE 2800-2022 IBR Interconnection and Interoperability Standard21
CHAPTER 3: Gap Analysis of Risks
Timeline of Events and Industry/Regulatory Actions
Gap Analysis on Risks versus Mitigations23
Gap Analysis on the Adoption of Risk Mitigations by Industry23
Adoption of IEEE 2800-2022 in the Reviewed FIRs24
Adoption of NERC Guidance Regarding IBR Interconnection Requirements
Additional IBR-Related Requirements or Topics Addressed26
Interconnection Requirements Enhancements in Other Areas



Key Findings from Gap Analysis	27
CHAPTER 4: Key Findings and Recommendations	29
Recommended WIRAB Advisory Feedback for WECC and the ERO Enterprise	29
Near-Term (1–2 Years) Recommendations	
Medium Term (3–4 Years) Recommendations	31
Long-Term (2030+) Recommendations	32
Additional Recommendations for State Commissions	



LIST OF ACRONYMS

Acronym	Definition		
BES	Bulk Electric System		
BESS	Battery Energy Storage System		
BPS	Bulk Power System		
EMT	Electromagnetic Transient		
ERO	Electric Reliability Organization		
ERS	Essential Reliability Service		
FERC	Federal Energy Regulatory Commission		
GIA	Generator Interconnection Agreement		
GIP	Generator Interconnection Procedure		
GO	Generator Owner		
GOP	Generator Operator		
IBR	Inverter-Based Resource		
IEEE	Institute of Electrical and Electronics Engineers		
IRP	Integrated Resource Plan		
IRPS	NERC Inverter-Based Resource Performance Subcommittee		
ISO	Independent System Operator		
NERC	North American Electric Reliability Corporation		
OEM	Original Equipment Manufacturer		
PV	Photovoltaic		
RAS	Remedial Action Scheme		
RMS	Root-Mean-Square		
ROCOF	Rate of Change of Frequency		
ROP	Rules of Procedure		
RPS	Renewable Portfolio Standard		
RSTC	NERC Reliability and Security Technical Committee		
RTO	Regional Transmission Organization		
SCR	Short Circuit Ratio		
ТО	Transmission Owner		
ТОР	Transmission Operator		
WECC	Western Electricity Coordinating Council		
WIEB	Western Interstate Energy Board		
WIRAB	Western Interconnection Regional Advisory Body		



INTRODUCTION

Background and Scope

The Western Interconnection Regional Advisory Body (WIRAB) is a Section 215(j) regional advisory body that has the authority to advise the Federal Energy Regulatory Commission (FERC), the North American Electric Reliability Corporation (NERC), and the Western Electricity Coordinating Council (WECC) on matters pertaining to electric grid reliability in the Western Interconnection (see **Figure 1.1**). This may include advising on proposed reliability standards, WECC governance and budgets, and other topics that are in the West's economic and societal benefits. WIRAB seeks consensus among its members prior to submitting advice on important reliability matters and FERC may give deference to the advice of WIRAB.

The unprecedented growth of renewable, inverter-based resources (IBRs) is the single largest driver of grid transformation across North America. Past work by the Electric Reliability Organization (ERO) Enterprise has repeatedly highlighted the risks associated with abnormal inverter performance, inaccurate IBR modeling and studies, poor IBR commissioning practices, and the need for proactive risk mitigation particularly in the West to address



dress

these issues before a large-scale outage occurs. The ERO Enterprise continues to also highlight that the magnitude and frequency of occurrence of these types of issues is rising rapidly and needs to be addressed immediately.

There are increasing concerns from FERC and the ERO that industry may not be addressing emerging reliability risks associated with this energy transition and grid transformation in the most effective, efficient, and agile manner. IBRs continue to connect to the grid with potential underlying modeling and performance issues as well as introducing unique challenges that must be managed. It is imperative that the full capabilities of modern inverter technology be used to maximize the benefits this new technology can provide to the grid. Underutilizing modern inverter technology may undermine a successful energy transition as well as have serious adverse impacts on ratepayers. This paper explores risks that IBRs may present to BPS reliability; however, IBRs can present unique benefits and opportunities for BPS reliability if planned, designed, and operated in a manner that supports BPS reliability.

In 2024, WIRAB commissioned this assessment of IBR-related risks in the Western Interconnection. The assessment focuses specifically on growing levels of IBRs in the West, and potential regulatory and policy recommendations that could more proactively address challenges during the energy transition and help ensure a reliable, resilient, and affordable BPS across the Western Interconnection. The assessment is



intended to introduce unique perspectives and thought-provoking considerations for WIRAB stakeholders that could expedite effective regulatory action that supports Western stakeholders broadly.

Growth of IBRs Across the West

The Western Interconnection is experiencing a rapid growth of renewable energy resources driven by economics, renewable energy policies, and Renewable Portfolio Standards (RPS). Most states and many utilities across the Western Interconnection have some form of RPS or voluntary renewable energy targets (see Table 1.1).¹ Examples from a brief review of IRPs from for some larger utilities across the West also highlight the rapid rise of IBRs:

- Idaho Power:² The Idaho Power 2023 IRP Preferred Portfolio includes around 6,375 MW of IBRs (1800 MW of wind, 3325 MW of solar, and 1250 MW of BESS).
- NV Energy:³ The NV Energy 2024 IRP includes adding 1,000 MW of solar, 1,000 MW of BESS, and 400 MW of natural gas peaking units.
- PacifiCorp:⁴ The PacifiCorp 2023 IRP includes more than 9,800 MW of new wind, 2,000 MW of storage, ⁵ 3,760 MW of solar (mostly paired with BESS), 5,385 MW of natural gas, and 5,550 MW of energy efficiency and demand response.
- Xcel:⁶ Xcel highlights in its Phase I Colorado Clean Energy Plan 2021 IRP that "unprecedented amounts of renewable energy" will be added to the grid, with plans for over 3,500 MW of wind and solar, over 1,800 MW of storage, and 670 MW of natural gas.

Table I.1. Renewable Portfolio Standards by State			
State	Туре	Description	
Washington	RPS	15% by 2020, greenhouse gas neutral by 2030, 100% renewable/zero-emitting by 2045	
Oregon	RPS	Reduce emissions by 80% by 2030, 90% by 2035, 100% by 2040	
Idaho	-	-	
Montana	-	-	
Wyoming	-	-	
California	RPS	44% by 2024, 52% by 2027, 60% by 2030, 100% clean energy by 2045	
Nevada	RPS	50% by 2030, non-binding 100% carbon-free by 2050	
Utah	Target	20% by 2025	
Colorado	RPS	30% by 2020 for IOUs, ⁷ 100% clean energy by 2050 for utilities ≥ 500,000 customers	
Arizona	RPS	15% by 2025	
New Mexico	RPS	40% by 2025, 80% renewable by 2040, 100% zero-carbon by 2045	
Texas	RPS	10,000 MW by 2025	

plan/2023 IRP Update.pdf

¹ https://www.ncsl.org/energy/state-renewable-portfolio-standards-and-goals

² https://docs.idahopower.com/pdfs/AboutUs/PlanningForFuture/irp/2023/2023-irp-final.pdf

³ <u>https://www.nvenergy.com/publish/content/dam/nvenergy/brochures_arch/cleanenergy/IRP-Info-Sheet.pdf</u>

⁴ https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-

⁵ Including batteries collocated with solar, standalone batteries, and pumped storage hydro (which is not an IBR).

⁶ https://www.xcelenergy.com/staticfiles/xe-responsive/Archive/SPS-New-Mexico-IRP.pdf

⁷ 10% or 20% for municipalities and cooperatives, based on size.



The generator interconnection queues govern the procedures and agreements for generators seeking access to the transmission system⁸ and they provide a clear indication of the types of technologies being pursued over the next decade or so. Presently, the vast majority of newly connecting generators to the BPS are IBRs – solar photovoltaic (PV), wind, battery energy storage systems (BESS), and hybrid plants consisting of these technologies (see Figure 1.2). Over 97% of the generator interconnection queues in the Western Interconnection are comprised of IBRs today.⁹



Figure I.2. Generation queues across the United States [Source: LBNL]

The 2023 WECC *Western Assessment of Resource Adequacy*¹⁰ also highlighted that the Western Interconnection expects 95 GW of resource additions over the next 10 years, with 80% of those interconnections being solar PV, energy storage (mostly BESS), and wind (see **Figure I.3**). While not all of these proposed projects are likely to materialize, this is another credible indicator that the majority of new resource additions in the West are expected to be IBRs moving forward.



Figure I.3. Historical and planned Wind, Solar, and Storage in the WECC [Source: WECC]

⁸ https://www.ferc.gov/electric-transmission/generator-interconnection

⁹ <u>https://emp.lbl.gov/maps-projects-region-state-and-county</u>

¹⁰ https://www.wecc.org/Administrative/2023%20Western%20Assessment%20of%20Resource%20Adequacy.pdf


Both these assessments send a clear and definitive message that the future power grid in the West will be increasingly dominated by IBRs in the years ahead. Therefore, it is imperative for industry to prepare for and minimize potential risks for that future state.

IBR Risk Assessment Process

With IBR levels rapidly growing across the West, this assessment briefly explains potential challenges that may arise, issues industry has faced thus far, risk mitigations being pursued, and potential gaps where additional recommended actions may help mitigate reliability risks across the Western Interconnection. Figure 1.4 illustrates the high-level process used for conducting this assessment.



Figure I.4. IBR Risk Assessment Process

This work provides unique perspectives to the following questions for WIRAB and its stakeholders, focusing specifically on the activities of FERC, NERC, and WECC given WIRAB's unique role of providing West-wide input to these efforts:

- What led to the increasing number of large-scale IBR-related events across the West and other Interconnections? What are the root causes of those events?
- What solutions are available to mitigate those risks and what is being done to implement them in the West?
- Are the current risk mitigation measures by industry and regulatory bodies sufficient to keep up with the rapid pace of change occurring across the West?
- How can new regulatory requirements strike a balance between uniformity and flexibility?
- Are current planning and operational requirements and practices adequately studying future grid states to identify potential risks early and proactively develop solutions?
- How do we move from admiring the problems associated with grid transformation and the energy transition to effectively addressing those problems with least-cost, proactive risk mitigations?



CHAPTER 1: Prioritized List of IBR Risks in the West

The energy transition toward renewable energy resources is transforming the BPS across the US and around the world. There are many ways to identify, analyze, and articulate the risk landscape presented by IBRs (and the unique benefits and opportunities that IBRs can provide). This assessment takes a two-pronged approach. First, systems integration¹¹ challenges associated with IBRs are outlined (e.g., essential reliability services such as frequency control, protection system operation, stability, etc.).¹² Second, these challenges are considered within the lifecycle of an IBR plant – from resource procurement to interconnection and commissioning processes and into grid operations, modeling, and studies. Before defining and prioritizing these risks, let us first explore some formative events leading up to this assessment.

Observations and Indicators of IBR Performance Risks

There are multiple examples of large system-wide outages that serve as early indicators of high IBR challenges ahead more broadly across electricity networks around the world. Below are a few examples.

NERC Disturbance Reports

NERC has reported on abnormal IBR performance and associated risks posed by IBRs for nearly a decade (see **Figure 1.1**), first starting with the infamous Blue Cut Fire disturbance involving many solar PV resources that abnormally responded to a normally cleared BPS fault event. A dozen or so other events subsequently occurred in the years following, and NERC published multiple reports documenting key findings and recommendations for industry including important guidance documents that were used in the early developments of IEEE 2800-2022.^{13,14} In 2022, multiple events involving the abnormal performance of BESS were identified and then in 2023 a large disturbance involving multiple solar plants in Southwest Utah also occurred, noting the first major IBR-related event in the Western Interconnection outside California.



Figure 1.1. Infamous NERC Reports of IBR Events in the West

¹¹ Systems integration refers to the harmonization of power system elements, controls, protections, and processes including IBRs and synchronous generation, advanced grid technologies, and conventional network components to ensure reliable, affordable, and efficient delivery of electricity to end-use customers.

¹² The Energy Systems Integration Group (ESIG) is a non-profit organization with the intent of exploring these technical systems integration challenges in much more detail and fosters open collaboration across industry stakeholders.

¹³ <u>https://www.nerc.com/pa/rrm/ea/Pages/Major-Event-Reports.aspx</u>

¹⁴ https://www.nerc.com/comm/Pages/Reliability-and-Security-Guidelines.aspx



The NERC reports have documented risks that IBRs may pose to the BPS if not addressed in a timely and proactive manner. In addition, NERC has repeatedly highlighted resource adequacy and energy assurance issues as well as interconnection challenges. Many of the IBR performance-related risks stem from inadequate interconnection requirements that establish a clear expectation for how IBRs should be reliably integrated to the BPS. NERC also stressed the need to improve modeling and study requirements for IBRs to ensure accurate studies result in reliable decisions during the interconnection, planning, and operations horizons.

2016 South Australia Blackout

In 2016, South Australia experienced a complete blackout event due to extreme weather conditions that resulted in many grid faults and damage to transmission infrastructure. Wind plant protection operated unexpectedly, resulting in a sustained power reduction which caused a significant increase in power import through the main interconnection tie line. This triggered a special protection system (i.e., remedial action scheme (RAS)) that tripped the interconnector and caused islanding of the network from the rest of the Australian system. This caused a large frequency fluctuation and inability to support stable operation of the system, resulting in a blackout in the islanded network. The blackout event was another notable IBR-related event due to the unexpected tripping of wind plants due to protections not previously well understood, as well as the interactions with RAS and inability to sustain system stability when islanded due to large rate of change of frequency (ROCOF), challenges controlling voltage, and lack of grid stabilizing attributes from existing IBRs.¹⁵

2019 United Kingdom Load Shedding Event

In 2019, a large power outage occurred in the United Kingdom that interrupted over 1 million customers caused by a routine fault on the BPS. A large synchronous generator and a large offshore wind plant unexpectedly tripped as well as some distributed energy resources (DERs), causing frequency to drop rapidly that subsequently tripped a very large amount of DERs across the system. The combined loss of generation caused frequency to further decline and resulted in load shedding. This event illustrated how large-scale events involving the response and interactions between multiple resource types (e.g., synchronous, IBRs, DERs) can lead to grid reliability risks.¹⁶

2021 and 2022 Odessa Disturbances in Texas

In 2021, Texas experienced the unexpected tripping of a large amount of solar PV resources from a wide array of causes that resulted from a normally cleared fault at a synchronous generation facility. Texas had undergone a rapid rise in solar PV growth in the years prior, and this large-scale abnormal IBR performance event raised concerns of the systemic risk issues previously identified in California. Subsequently, in 2022, a nearly identical fault occurred that resulted in a substantially larger generator tripping event that also involved IBRs and synchronous generation tripping offline, nearly exceeding Texas' largest resource loss protection criteria. Electric Reliability Council of Texas (ERCOT) and its resource entities convened a

¹⁵ <u>https://www.aemo.com.au/-</u>

<u>/media/Files/Electricity/NEM/Market Notices and Events/Power System Incident Reports/2017/Integrated-Final-Report-SA-Black-System-28-September-2016.pdf</u>

¹⁶ https://www.ofgem.gov.uk/sites/default/files/docs/2020/01/9 august 2019 power outage report.pdf



stakeholder group to deploy mitigations to nearly all existing and newly connecting resources across the Texas system.^{17,18}

Systems Integration Challenges with Growing IBRs

Ongoing large-scale grid disturbances involving IBRs set a backdrop for outlining a more comprehensive set of systems integration challenges. Generating resources have historically provided "services" to the BPS, either procured or inherently provided;¹⁹ however, this assessment takes a broader approach by exploring a wider spectrum of systems integration challenges regarding IBR integration. **Table 1.1** shows a breakdown of the categories of challenges and some of the areas of focus within each category. This paper does not dive deep into the specific technical details of these challenges; rather it is highlighting many of the key areas of focus that industry is collectively working on as they relate to IBR impacts to overall BPS reliability and systems integration moving forward. (Note: The challenges outlined in **Table 1.1** are not all-comprehensive as this assessment does not consider economics-related or policy-related issues associated with IBR technologies; this assessment is focused on BPS reliability-related challenges.)

Table 1.1. IBR Systems Integration Challenges				
Resource Planning	Resource Adequacy and Firm Capacity Planning			
	Energy Assurance and Energy Security			
Security	Cyber and Physical Security			
Market Integration	Market Design and Services; Pricing and Incentives			
Modeling and Studies	 Powerflow, Dynamics, Short-Circuit, EMT 			
	Model Quality and Model Validation			
	 Study Assumptions, Scenarios, and Analyses 			
System Restoration	Blackstart Resources (Islanded Mode Operation)			
	Cranking Paths			
Reserves	Regulating Reserves			
	 Contingency Reserves – Spinning, Non-Spinning, Replacement 			
	Ramping Reserves			
Pseudo Steady-State Essential	 Balancing, AGC Control (Dispatchability), and Curtailment 			
Reliability Services	 Ramping Control and Variability Smoothing 			
	Voltage Control			
	Frequency Control			
Dynamic Essential Reliability	 Frequency Response (Fast and Primary) 			
Services	 Stability (Inertial Response, Controller Tuning, Etc.) 			
	Low System Strength Operation			
	Grid Forming Controls			
	Subsynchronous Oscillations			
	Dynamic Performance Conformity			
Protection and Short Circuit	BPS Protection System Design			
	 Fault Current Magnitude and Phase Relationship 			
	Negative Sequence Current Injection			
Power Quality	Harmonics, Transients, and Flicker			
RAS Design and Interactions	RAS Controller Design			
	 Safety Net Schemes (e.g. UFLS, UVLS) 			

¹⁷ https://www.nerc.com/pa/rrm/ea/Documents/Odessa Disturbance Report.pdf

¹⁸ https://www.nerc.com/comm/RSTC Reliability Guidelines/NERC 2022 Odessa Disturbance Report%20(1).pdf

¹⁹ https://escholarship.org/uc/item/75d2n2dw



The categories of services span the complete time spectrum from microseconds (i.e., protection system operation and BPS stability) to years (i.e., resource planning and long-term investment decision making). Figure 1.2 provides an illustrative representation of this spectrum of systems integration challenges and their respective timeframes.



Figure 1.2. Timeframes of IBR Systems Integration Challenges

Prioritizing IBR Systems Integration Challenges

Each systems integration challenge described above was considered across the following phases of the lifecycle of an IBR plant:²⁰

- **Resource Procurement:** This encompasses all aspects of studying and procuring sufficient resources as well as pre-queue entry for proposed generator interconnection requests.
- Long-Term Transmission Planning: This encompasses the long-term planning horizon and how IBRs can affect BPS planning decision making.
- **Generator Interconnection Process:** This includes all aspects of working through the generator interconnection queue process from initial request up through trial operation and commissioning.
- **IBR Plant Commissioning:** This specifically focuses on the IBR commissioning practices leading to trial operation and commercial operation date.
- **Operations:** This includes operational planning and real-time operations as well as electricity market operations.

With this matrix of systems integration challenges versus phases of an IBR plant lifecycle, the impacts that IBRs can have on BPS reliability were assessed using the following high-level criteria:

What is the magnitude or pervasiveness of the challenge presented?

²⁰ Again, there are many ways to describe how systems integration challenges affect different aspects of grid planning, engineering, and operations. The authors chose this approach for its simplicity and straightforward nature.



- Are there technological solutions to address the challenge and, if so, are they cost-effective and ready for deployment?
- Is the challenge well understood and are the tools, models, and studies available to fully understand potential risks?

Figure 1.3 shows the relative risk ranking and risk prioritization for the various systems integration challenges across the different IBR lifecycle phases. Note again that all these issues are worthy of industry attention; however, those risks with higher risk priority percentage on the chart stand out more so than others in terms of how IBRs can impact grid reliability in the years ahead.



Figure 1.3. IBR Risk Priorities for Systems Integration through an IBR Lifecycle

There are many other ongoing initiatives and risk mitigation efforts across the ERO Enterprise such as extreme weather transmission planning, cold weather preparedness, cyber and physical security resilience, energy assurance, probabilistic planning, generator availability data reporting for IBRs, and others. Given WIRAB's advisory role of WECC, NERC, and FERC, and the focus of this assessment being specifically on IBR risks, the following chapters are going to focus on FERC and ERO Enterprise activities in the area of IBR-centered risk mitigations and the role that requirements and standards play in ensuring grid reliability under rapid grid transformation. Challenges and risks focused on markets, economics, security, etc., are not a focal point of this assessment.



CHAPTER 2: Current Industry Risk Mitigation Activities

Risk mitigation efforts are underway across jurisdictions and stakeholders in the Western Interconnection. This chapter lays out efforts across FERC, NERC, WECC, and industry stakeholders (see Figure 2.1).

FERC Orders and Directives

Starting at the federal level, FERC issued landmark directives regarding IBRs including:

- FERC Order on Registration of IBRs (November 2022): FERC directed NERC to identify and register owners and operators of BPS-connected IBRs that are not currently registered with NERC under the Bulk Electric System (BES) definition that have an "aggregate, material impact on the reliable operation of the BPS."²¹
- **FERC Order No. 2023 (July 2023):** FERC reformed its *pro forma* generator interconnection procedures (GIP) and generator interconnection agreements (GIA) "to address interconnection queue backlogs, improve certainty, and prevent undue discrimination for new technologies."^{22,23,24}
- FERC Order No. 901 (October 2023): FERC directed NERC to develop new or modified Reliability Standards that "address reliability gaps related to inverter-based resources" in the areas of data sharing, model validation, planning and operational studies, and performance requirements.²⁵



Figure 2.1. Jurisdictions and Stakeholders

FERC Order 2023

FERC Order No. 2023 was predominantly focused on reforming the generator interconnection queue process with significant changes to the GIPs and GIAs moving to a "first-ready, first-served" cluster study approach with expedited study timelines, allowing for technological advancements, and requiring assessment of alternative technologies.²⁶ However, the order specifically included the following requirements for IBRs:

- Modeling: Interconnection customers are required to submit to the transmission provider:
 - o A validated user-defined RMS positive sequence dynamic model
 - An appropriately parameterized generic library RMS positive sequence dynamic model that corresponds to a model listed in a new table of acceptable models or a model otherwise approved by WECC
 - A validated EMT model if the transmission provider performs an EMT study as part of the interconnection study process
- **Ride-Through Performance:** Frequency and voltage ride-through, within equipment limitations, is required which includes continued active power production performance criteria during and post-

²¹ https://www.ferc.gov/media/e-1-rd22-4-000

²² https://www.ferc.gov/media/e-1-order-2023-rm22-14-000

²³ <u>https://www.ferc.gov/explainer-interconnection-final-rule</u>

²⁴ https://www.ferc.gov/media/e1-rm22-14-001

²⁵ https://www.ferc.gov/media/e-1-rm22-12-000

²⁶ This included the *pro forma* Large Generator Interconnection Procedure (LGIP), Small Generator Interconnection Procedure (SGIP), Large Generator Interconnection Agreement (LGIA), and Small Generator Interconnection Agreement (SGIA).



disturbance, minimized reduction in active power while providing reactive power support, no artificial limitations in dynamic reactive power capability, and return to pre-disturbance active power output levels with no artificial ramp rate restrictions.

A significant focus for industry moving forward will be how to effectively implement FERC Order No. 2023 process reforms – expedited study timelines, allowing changes throughout the interconnection process, etc. – without degrading grid reliability during this process.

NERC IBR Registration Initiative

NERC submitted to FERC a three-phase work plan regarding IBR registration activities (see Figure 2.2) following the FERC Order on Registration of IBRs.²⁷ Phase 1 (2023-2024) involved revisions to the NERC Rules of Procedure (ROP), which were approved by FERC at their June 2024 Open Meeting. The ROP revisions involve revising the Generator Owner (GO) and Generator Operator (GOP) Registry Criteria to include owners and operators of 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.²⁸ These newly registering entities will be referred to as Category 2 GOs and Category 2 GOPs. The IBR Registration effort will bring the coverage of NERC-jurisdictional IBRs (in terms of number of resources) from around 84% to 98%, which is more consistent with past trends for synchronous generator GO registrations.²⁹



Figure 2.2. IBR Registration Milestones [Source: NERC]

Phase 2 (2024-2025) will involve outreach, education, and initial registration of applicable Category 2 GOs/GOPs; Phase 3 (2025-2026) will involve completing the registration of applicable Category 2 GOs/GOPs and their applicable IBR facilities, and then applying applicable NERC Standards to those newly registered entities and facilities.

NERC Standards Developments for Order 901

NERC created a standards prioritization approach³⁰ that categorizes each NERC standards development project based on whether it involves a FERC or NERC Board directive, has a regulatory deadline, or is linked to strategic ERO Enterprise risk priorities. NERC submitted a work plan in response to FERC Order No. 901

²⁹ NERC Work Plan for IBR Registration:

²⁷ https://www.nerc.com/comm/RSTC/Documents/IBR_Registration_Quick_Reference_Guide.pdf

²⁸ NERC explains that the aggregation method is consistent with the NERC BES Inclusion I4 aggregations.

https://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/IBR%20Registration%20Work%20Plan_final.pdf 30 https://www.nerc.com/pa/Stand/Documents/Priortization%20PPT_February%202024.pdf.pdf



that laid out its plans regarding four key milestones regarding filings to FERC that address the standard development directives. All projects were therefore ranked high priority. The key milestones include:³¹

- Milestone 1 (due January 2024): Informational filing of work plan.
- Milestone 2 (due November 2024): Revisions for IBR disturbance monitoring (PRC-028), IBR ride-through performance (PRC-029), and post-event IBR performance validation (PRC-030)
- **Milestone 3 (due November 2025):** Revisions for IBR and DER data sharing and model validation, which is presently revamping three existing modeling-related standards development projects:
 - Project 2020-06 Verifications of Models and Data for Generators³²
 - Project 2021-01 Modifications to MOD-025 and PRC-019³³
 - Project 2022-02 Uniform Modeling Framework for IBR³⁴
- Milestone 4 (due November 2026): Revisions for planning and operational studies related to IBRs, which has yet to be fully defined by NERC at this time.

The directives in FERC Order No. 901 issued to NERC are some of the most expansive NERC Reliability Standards revisions since FERC Order No. 693. The Order 91 directives impact IBR design and commissioning, grid planning and operations, modeling and studies, among other topics. However, all directives are based on backward-looking risks that NERC has observed and assessed for nearly a decade; therefore, it is important to ask whether these directives will suffice under such a rapidly changing IBR landscape and whether a more agile approach is fundamentally needed.

NERC IRPS Activities

The NERC Inverter-Based Resource Performance Subcommittee (IRPS), a stakeholder group under NERC's Reliability and Security Technical Committee (RSTC),^{35,36} has published various guidelines and reports that have led to some regulatory actions including standard authorization requests (SAR) for new or enhanced NERC Reliability Standards revisions, as well as FERC Order No. 901.³⁷ The IRPS is presently working on a few activities:

- 1. White Paper: BPS-Connected IBR Commissioning Best Practices
- 2. SAR: Revision to FAC-001 and FAC-002
- 3. Reliability Guideline: Recommended Approach to Interconnection Studies for BPS-Connected IBRs

The proposed SAR mirrors the clauses of IEEE 2800-2022 in terms of proposed enhancements to interconnection requirements and emphasizes a lack of industry adoption of voluntary recommendations put forth in NERC guidance. The SAR does not recommend adoption of IEEE 2800-2022 directly; rather, it takes a roundabout approach wherein individual TOs are responsible for enhancing their requirements in

³¹ NERC Informational Filing on Order 901 Implementation:

https://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/NERC%20Compliance%20Filing%20Order%20N_0%20901%20Work%20Plan_packaged%20-%20public%20label.pdf

³² <u>https://www.nerc.com/pa/Stand/Pages/Project-2020_06-Verifications-of-Models-and-Data-for-Generators.aspx</u>

³³ https://www.nerc.com/pa/Stand/Pages/Project 2021-01 Modifications to MOD-025 and PRC-019.aspx

³⁴ https://www.nerc.com/pa/Stand/Pages/Project2022-02ModificationstoTPL-001-5-1andMOD-032-1.aspx

³⁵ <u>https://www.nerc.com/comm/RSTC/Pages/IRPS.aspx</u>

³⁶ https://www.nerc.com/comm/RSTC/Pages/default.aspx

³⁷ https://www.nerc.com/comm/Pages/Reliability-and-Security-Guidelines.aspx



a manner duplicative with IEEE 2800-2022. This concern will be discussed in more detail in subsequent sections and illustrates how regulatory uncertainty and lack of unification can lead to inconsistencies and gaps that could lead to reliability risks.

Other NERC Activities

As noted previously, there are other ongoing NERC activities and Standards development activities that indirectly relate to IBRs but are considered outside the scope of this assessment. Examples include:

- Energy Assurance: Multiple NERC Standards revisions are underway with Project 2022-03 and Project 2024-02 related to energy reliability assessments to ensure sufficient energy availability and assurance with increasingly intermittent and variable resources (much of which are IBRs).^{38,39} The NERC Energy Reliability Assessment Task Force (ERATF) developed a concept paper on this topic that partially led to these efforts.⁴⁰
- Transmission Planning for Extreme Weather: FERC issued Order No. 896 in June 2023 directing NERC to develop or modify standards to address a lack of long-term planning requirements for extreme heat and cold weather events, including modifications to NERC TPL-001-5.1.⁴¹ Efforts are underway to develop a benchmark planning scenario/case for both steady-state and transient stability analyses that includes widespread impacts of extreme weather. These studies must also include corrective actions to mitigate instances where performance requirements are not met.⁴²
- Cyber and Physical Security Enhancements: The Electricity Information Sharing and Analysis Center (E-ISAC) continues to hold workshops, trainings, and events for industry to gain insights and recommendations regarding security topics.⁴³ Additionally, there are multiple NERC Standards projects underway related to cyber and physical security standards enhancements for CIP-002,⁴⁴ CIP-003, ⁴⁵ and CIP-014.⁴⁶
- **Cold Weather Preparedness:** NERC has held small group advisory sessions for Registered Entities to prepare for cold weather conditions. NERC also developed NERC EOP-012 for generator cold weather conditions and continues to modify the standard based on directives from FERC.⁴⁷
- Interregional Transfer Capability: Congress mandated in the Fiscal Responsibility Act of 2023 that NERC conduct a study of the interregional transfer capability between areas of the interconnected transmission system. The study aims to identify existing transfer capabilities, make recommendations on "prudent additions" to the amount of electric power that can be moved between areas, and recommendations on how to achieve and maintain these total transfer capabilities.⁴⁸

- ³⁹ https://www.nerc.com/pa/Stand/Pages/Project-2024-02-Planning-Energy-Assurance.aspx
- ⁴⁰ https://www.nerc.com/comm/RSTC/ERATF/ERATF%20Energy%20Adequacy%20White%20Paper.pdf
- ⁴¹ https://www.ferc.gov/media/e-1-rm22-10-000
- ⁴² https://www.nerc.com/pa/Stand/Pages/Project-2023-07-Mod-to-TPL00151.aspx

46 https://www.nerc.com/pa/Stand/Pages/Project 2023-06 CIP-014 Risk Assessment Refinement.aspx

³⁸ <u>https://www.nerc.com/pa/Stand/Pages/Project2022-03EnergyAssurancewithEnergy-ConstrainedResources.aspx</u>

⁴³ https://www.eisac.com/s/

⁴⁴ https://www.nerc.com/pa/Stand/Pages/Project%202021-03%20CIP-002%20Transmission%20Owner%20Control%20Centers.aspx

⁴⁵ <u>https://www.nerc.com/pa/Stand/Pages/Project-2023-04-Modifications-to-CIP-003.aspx</u>

⁴⁷ https://www.nerc.com/pa/Stand/Pages/Project-2024-03-Revisions-to-EOP-012-2.aspx

⁴⁸ https://www.nerc.com/pa/RAPA/Pages/ITCS.aspx



WECC Studies of IBR Risks

WECC has not developed any Regional Reliability Standards in response to any of the IBR risks identified by the ERO Enterprise. Rather, WECC has conducted some reliability studies exploring future grid reliability risks:

- **Grid Forming Inverter Study:** This study explored the integration of grid forming (GFM) IBRs to replace or complement conventional grid following (GFL) IBRs and its impacts on supporting frequency response in the Western Interconnection with decreasing system inertia levels. The studies used a relatively new generic model of GFM technology, as opposed to actual OEM-supplied models, but showed that increasing the deployment of GFM resources can have a significant positive impact on Western Interconnection frequency stability. Recommendations urged Planning Coordinators to consider GFM technology moving forward and the WECC Underfrequency Load Shedding Working Group to further explore generation loss events in the West.^{49,50}
- Changes in Grid Strength Study: This study explored the changes of fault current and system strength levels for an incremental replacement of synchronous generation with IBRs. No significant changes in fault current level or grid short-circuit ratio (SCR) were identified. WECC recommended (1) its Short-Circuit Modeling Subcommittee to continue working with software vendors and industry to establish recommendations on how IBRs are represented in short circuit models and (2) industry to urge inverter OEMs to share modeling data to enable the creation of improved short-circuit models for IBRs.^{51,52}

Both studies are introductory exploratory studies to further define WECC-wide grid reliability impacts of IBRs and can serve as a foundational basis for further work. However, the recommendations do not urge more detailed analysis or mitigating measures to be put into place at this time. This is an area that could be further codified by WECC and its stakeholders – defining further next steps to explore these types of concepts with more granularity.

Industry Efforts to Manage IBR Risks

Some transmission providers (i.e., Transmission Owners (TOs) and/or ISO/RTOs) have begun taking actions to minimize risks of increasing levels of IBRs across their system. This may include improving generation interconnection requirements, adapting transmission planning and interconnection processes, enhancing IBR modeling requirements and studies, adopting new operating procedures and real-time tools, etc. An example includes proactive adoption of IEEE 2800-2022, which is discussed in more detail below.

These entities appear to have relatively higher levels of IBRs today and experience managing a system with higher levels of IBRs. Additionally, some of these entities are larger in size and therefore have the resources and capabilities to adapt more quickly during the energy transition. These types of considerations are a focal point of the risk assessment described in **CHAPTER 3**: *Gap Analysis of Risks*.

⁴⁹ https://www.wecc.org/Administrative/Grid%20Forming%20Inverter%20Study%20Overview.pdf

⁵⁰ https://www.wecc.org/Administrative/Grid%20Forming%20Inverter%20Study%20Report.pdf

⁵¹ https://www.wecc.org/Administrative/Changes%20in%20Grid%20Strength%20Overview.pdf

⁵² https://www.wecc.org/Administrative/Changes%20in%20Grid%20Strength%20Study.pdf



IEEE 2800-2022 IBR Interconnection and Interoperability Standard

IEEE 2800-2022, Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power establishes uniform technical minimum Systems, requirements for the interconnection, capability, and performance of IBRs interconnecting with transmission and sub-transmission systems (see Figure 2.3).53 IEEE 2800-2022, like all IEEE standards, is a voluntary standard that requires enforcement by an "authority governing interconnection requirements (AGIR)."54 This entity should be one that is responsible for the interconnection of IBRs to the BPS such as the transmission provider (TO, ISO/RTO, or other regulatory body). The higher up the regulatory framework that IEEE 2800-2022 can be adopted, the more uniformity and consistency that will be achieved. Standardized adoption of IEEE 2800-2022 has been strongly encouraged by the U.S. Department of Energy (DOE),⁵⁵ IEEE

EEE SA	3
IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems	ANDARDS
IEEE Power and Energy Society	ST
Developed by the transp investigation & Preser Generation Specificate Network Michigany Committee, and Preser Spring Relation Relaying & Control Committee	
9531 Init 2000**-0023	
♦ IEEE	

Figure 2.3. IEEE 2800-2022 Standard

2800-2022 leadership and membership, and other organizations. However, both NERC and FERC have been resistant to adopting IEEE 2800-2022.

IEEE 2800-2022 received high ballot results from a large body of industry experts across a broad spectrum of organizations. Many of the same experts who developed IEEE 2800-2022 are now working on IEEE P2800.2, *Recommended Practice for Test and Verification Procedures for Inverter-based Resources Interconnecting with Bulk Power Systems*, which will define the test and verification methods to demonstrate plant-level conformance with the requirements in IEEE 2800-2022.⁵⁶

As will be discussed in <u>CHAPTER 3: Gap Analysis of Risks</u>, IEEE 2800-2022 can serve a critically important role for ensuring reliable operation of the BPS moving forward if adopted consistently and appropriately at the regulatory level.

⁵³ https://standards.ieee.org/ieee/2800/10453/

⁵⁴ An AGIR is defined as a "cognizant and responsible entity that defines, codifies, communicates, administers, and enforces the policies and procedures for allowing electrical interconnection of inverter-based resources interconnecting with associated transmission systems." An AGIR could be the ISO/RTO, a public utility commission, a municipality or cooperative board, etc.

⁵⁵ https://www.energy.gov/sites/default/files/2024-04/i2X%20Transmission%20Interconnection%20Roadmap_1.pdf

⁵⁶ https://standards.ieee.org/ieee/2800.2/10616/



CHAPTER 3: Gap Analysis of Risks

CHAPTER 1: *Prioritized List of IBR Risks in the West* laid out a subset of IBR reliability risks that should be addressed proactively either at the regulatory level and/or by individual transmission providers. As new IBR integration and systems integration challenges are uncovered, industry needs to address them in an effective, efficient, and agile manner. **CHAPTER 2:** *Current Industry Risk Mitigation Activities* highlighted various activities and initiatives underway at the FERC, NERC, and WECC level that are attempting to address these risks to some degree. This chapter will explore any potential gaps in these efforts and identify areas where additional focus and support may be needed.

Timeline of Events and Industry/Regulatory Actions

NERC started exploring BPS essential reliability services (ERS) in the mid-2010s and published the *ERS Measures Framework Report* in 2015.⁵⁷ In 2016, the Blue Cut Fire event was the first major widespread IBR-related disturbance in North America that began a sequence of over a dozen of these types of events. Most have been attributed to solar PV; however, more BESS and wind-related events are occurring in some regions with high penetration levels. In 2021 and 2022, large IBR-related events in Texas further raised the IBR risk priority level across industry since the 2022 event nearly exceeded Texas' resource loss protection criteria. NERC issued multiple Level 2 Alerts regarding IBR performance and modeling concerns. The NERC IRPS published guidelines providing recommended practices to address many of the identified risks and also initiated NERC Standards revisions projects to address gaps in NERC Standards. Concurrently, FERC addressed voltage and frequency control with FERC Order Nos. 827 and 842, respectively, and then issued FERC Order No. 901 after numerous IBR events to mandate changes to NERC Standards to fill the gaps involving IBR risks. Lastly, FERC also issued FERC Order No. 2023 to address interconnection queue backlog issues. Figure 3.1 shows a high-level illustrative overview of industry and regulatory actions taken to-date.



Figure 3.1. Timeline of Events, Guidance, Standards Revisions, and Directives

⁵⁷ https://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/ERSTF%20Framework%20Report%20-%20Final.pdf



The industry and regulatory activities highlighted in **Figure 3.1** bring up two fundamental questions that this assessment aimed to evaluate. The first question is: Are all the identified IBR risks being addressed by the various industry mitigation activities? The second question is: How well and how quickly is the industry adopting and implementing the various industry mitigation activities? The next sections of this chapter will present the gap analysis performed to answer these two questions.

Gap Analysis on Risks versus Mitigations

With all these industry activities underway, one would assume that sufficient risk mitigations are being developed that will adequately address all the identified issues with grid reliability. However, as **Table 3.1** highlights, there are IBR risks where no significant industry efforts or regulatory policies were identified that addressed the risks.

Table 3.1. IBR Systems Integration Challenges vs. Industry Activities				
Resource Planning	•	Addressed by NERC Project 2022-03 – Energy Assurance		
Modeling and Studies	•	Addressed by IEEE 2800, FERC Order 2023, FERC Order 901, and the NERC Milestone 3 and 4 standards per Order 901		
Pseudo Steady-State Essential Reliability Services	•	Addressed by IEEE 2800, FERC Order 901, and the NERC Milestone 2 standards per Order 901		
Dynamic Essential Reliability Services	•	Addressed by IEEE 2800 (voluntary adoption) Not addressed by any draft NERC standards for Order 901		
Protection and Short Circuit	• *	Addressed by IEEE 2800, along with the proposed SAR from IRPS Not addressed by any draft NERC standards for Order 901		
Power Quality	• *	Addressed by IEEE 2800, along with the proposed SAR from IRPS Not addressed by any draft NERC standards for Order 901		
Reserves	٠	Addressed by NERC Project 2022-03 – Energy Assurance		
RAS Design and Interactions	No active industry efforts identified			
System Restoration	No active industry efforts identified			

This analysis highlights that Dynamic Essential Reliability Services, System Restoration, RAS Design, and Power Quality risks with IBRs are gaps in the current regulatory policy area and mandatory requirements for the industry, such as FERC Order 901 and the corresponding new IBR-based NERC Reliability Standards. However, IEEE 2800 does address two of these risk areas – Dynamic Essential Reliability Services and Power Quality – further highlighting the value and benefit of adopting IEEE 2800 by the industry, NERC, and FERC.

Gap Analysis on the Adoption of Risk Mitigations by Industry

The Western Interconnection is comprised of about eighty (80) TOs and forty-eight (48) Transmission Operators (TOPs).^{58,59} As part of this risk assessment, a subset of thirty-two (32) NERC FAC-001 Facility Interconnection Requirements (FIR) documents in the Western Interconnection were analyzed to understand how well the IBR risks are being mitigated by the interconnection requirements across the Western Interconnection as of the writing of this report. FIRs reviewed were publicly available on the OATI OASIS website⁶⁰ or directly on Western Interconnection utility websites.

⁵⁸ <u>https://www.wecc.org/Administrative/State%20of%20the%20Interconnection.pdf</u>

⁵⁹ <u>https://www.nerc.com/pa/comp/Registration%20and%20Certification%20DL/NERC_Compliance_Registry_Matrix_Excel.xlsx</u>

⁶⁰ http://www.oasis.oati.com/



Figure 3.2 provides an overview of the high-level findings regarding the review of thirty-two (32) FIRs and the enhancements that have been developed implemented thus far. Each FIR was briefly reviewed to determine the extent to which the NERC IBR Guideline,⁶¹ IEEE 2800-2022, or the additional systems integration challenges not covered by these publications (as highlighted in **Table 3.1**) were incorporated. Green indicates relatively comprehensive implementation of the reference(s), orange indicates some degree of implementation of the reference(s), and red indicates little or no consideration of the references.



Figure 3.2. Transmission Provider FIR Enhancements

NOTE: Navigating the local transmission provider facility interconnection requirements, business practices, generator interconnection agreements and procedures, and other supplemental documentation is rather complex and therefore there may be gaps or missed documents in this assessment. These documents are also updated at different times by all the entities; therefore, documents may have been recently updated compared to the time of the gap analysis and writing of the report. The goal of the assessment is to get a general gauge of industry practices collectively rather than thoroughly assessing the depth and breadth of any individual transmission provider.

Adoption of IEEE 2800-2022 in the Reviewed FIRs

As identified in the gap analysis of risks vs. mitigation measures earlier in this chapter, implementation of IEEE 2800-2022 is likely the most effective and efficient path to mitigating the IBR performance risks identified by NERC and the overall industry over the past decade. Unified adoption of IEEE 2800-2022 at the federal level (i.e., FERC and NERC) would result in the most harmonized implementation across North America; however, Western entities specifically, given the rapidly growing IBR penetration levels across the West, need to keep pace with this change and get mitigating measures in place now. IEEE 2800-2022 was approved and published in 2022, and NERC continues to emphasize enhancements to TO Facility Interconnection Requirements; TOs can enhance these requirements by adopting IEEE 2800-2022 as consistently as possible. Comprehensive adoption is generally recommended but a phased adoption of select requirements (e.g., Clause 7, 10, and 12) could also lead to risk mitigations to key concerns raised by regulatory bodies.

⁶¹ https://www.nerc.com/comm/RSTC Reliability Guidelines/Reliability Guideline IBR Interconnection Requirements Improvements.pdf



Of the 32 FIRs reviewed, only 6 reference IEEE 2800-2022 in some way. There are various adoption methods for including IEEE 2800-2022 requirements in FIRs; however, it is generally recommended that a "hybrid integration approach" be used that involves referencing the standard and providing sufficient technical details such that interconnection customers can effectively implement the standard at their IBR facilities. None of the 6 FIRs implement IEEE 2800-2022 in this way.

Overall, a few FIRs include general references to IEEE 2800-2022. A few others have included detailed references to some clauses in IEEE 2800-2022; however, practices were inconsistent. No FIRs have used a comprehensive hybrid integration approach wherein the necessary level of specificity is provided such that an interconnection customer would have enough data to comply with the requirements and seek interconnection approval effectively and efficiently.

Key Takeaway:

Only a small handful of FIRs have adopted IEEE 2800-2022 in some form. No FIRs have adopted the standard in a comprehensive manner that provides sufficient clarity and specificity such that inclusion of the standard in interconnection requirements would result in a more streamlined, effective, and efficient interconnection process for IBRs.

Adoption of NERC Guidance Regarding IBR Interconnection Requirements

NERC published multiple Reliability Guidelines prior to the publication of IEEE 2800-2022. Namely, *Reliability Guideline: Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources*⁶² was published in 2019 and the ERO Enterprise urged industry to implement the recommendations contained therein. These guidelines also served as foundational references for the initial draft of IEEE 2800. The guidance published recommended that transmission providers enhance their FIRs to address the IBR performance issues previously observed and other known areas of focus. **Table 3.2** provides a list of the topics covered.

Table 3.2. IBR Systems Integration Challenges				
Momentary cessation	Balancing			
Phase jump immunity	Monitoring			
Capability Curve	Operation in low short-circuit strength systems			
Active power-frequency controls	Fault ride-through capability			
Fast frequency response	Grid forming			
Reactive power-voltage control	System restoration and blackstart capability			
Reactive current-voltage control	Protection system settings			
Reactive power at no active power output	Power quality			
Inverter current injection during fault conditions	Modeling recommendations – timing, model quality, power			
	flow, dynamics, short-circuit, EMT, benchmarking			
Return to service following tripping				

Review of the FIRs found that about a third of those reviewed have adopted a limited subset of the NERC Guideline recommendations put forth; however, very few have adopted the recommendations broadly

⁶² https://www.nerc.com/comm/RSTC Reliability Guidelines/Reliability Guideline IBR Interconnection Requirements Improvements.pdf



(other than those that have adopted IEEE 2800-2022, which covers many of the recommendations listed in Table 3.2).

Additional IBR-Related Requirements or Topics Addressed

When reviewing the FIRs, additional IBR-related requirements and topics were surveyed, including EMT modeling for IBRs, low short circuit strength grid conditions for inverter stability, inverter oscillations, performance validation, and subsynchronous control interactions. All of these topics are additional industry recommendations and best practices for IBRs that go beyond the NERC Guideline and even in some ways beyond IEEE 2800-2022. About half of the FIRs reviewed had some of these topics addressed, which primarily was the EMT modeling analysis for IBRs during the interconnection process. In many cases the FIRs reference the need for generation interconnection customers to submit EMT models during the interconnection process but unclear the level of EMT study and analysis performed on those models during the process.

Interconnection Requirements Enhancements in Other Areas

Other ISO/RTOs and transmission providers outside the Western Interconnection are also actively pursuing updates to their interconnection requirements. Much of the Eastern Interconnection and ERCOT are market-based and therefore the ISO/RTO typically retains much of the generator interconnection requirements, interconnection queue management, market requirements, and operating procedures. Therefore, overall, these regions are further along and able to keep pace with rapid IBR growth since these entities tend to be highly staffed and tracking industry updates closely (e.g., similar to CAISO in the West).

Examples of ongoing activities in other areas include:

- MISO: MISO has undergone a relatively extensive review of IEEE 2800-2022 clauses and how they effectively integrate with existing MISO rules.⁶³ MISO proposed a three-phased approach moving from ride-through requirements to core system support, to expanded system support; eventually they intend to integrate remaining support services from IBRs such as blackstart and higher fault current levels. This effort culminated with FERC approving the MISO filing to revise their GIA to include requirements from IEEE 2800-2022.⁶⁴ Furthermore, MISO has also proposed draft GFM requirements for BESS to proactively enhance stability of the MISO system as IBR levels rise.⁶⁵
- ERCOT: ERCOT has also undergone a lengthy process to modify generator ride-through requirements for both existing and newly connecting IBRs with Nodal Operating Guide Revision Request (NOGRR) 245.⁶⁶ IEEE 2800-2022 requirements were integrated into this NOGRR for newly connecting resources and a "ride-through maximization" concept was introduced for all existing resources to minimize potential IBR-related ride-through failure risks. ERCOT also enhanced their dynamic modeling requirements for IBRs, introducing more stringent equipment change management processes that require testing of IBR plant models used in reliability studies. These changes were codified in Planning Guide Revision Request (PGRR) 109 approved in April 2024. In July 2024, ERCOT also approved changes to its disturbance monitoring equipment requirements

⁶³ https://cdn.misoenergy.org/20240312%20IPWG%20Item%2004c%20IBR%20Performance%20Requirements%20IEEE%202800%20(PAC-2024-2)632110.pdf

⁶⁴ https://elibrary.ferc.gov/eLibrary/filelist?accession_num=20240607-3041

⁶⁵ https://cdn.misoenergv.org/20240604%20IPWG%20Item%2004b%20Draft%20GFM%20BESS%20Performance%20Requirements%20Whitepaper%20(PAC-2024-2)633112.pdf

⁶⁶ <u>https://www.ercot.com/mktrules/issues/NOGRR245#keydocs</u>



with NOGRR 255, similarly mirroring what is in IEEE 2800-2022. Lastly, ERCOT has also proposed GFM requirements and test procedures for BESS.⁶⁷

- New York State Reliability Council (NYSRC): NYSRC oversees Reliability Rules in New York that shall be complied with by the New York Independent System Operator (NYISO) and all entities engaging in electric transmission, ancillary services, energy and power transactions on the New York power system. NYSRC, in February 2024, approved revisions to its Reliability Rules that incorporated a comprehensive hybrid integration approach to IEEE 2800-2022 implementation. The new rules describe each clause of IEEE 2800-2022 and how it will be enforced as well as any exceptions, modification, clarifications, and additional requirements.⁶⁸
- Southern Company: Southern Company has developed a standalone Interconnection Requirements for Transmission-Connected Inverter-Based Resources document, effective August 2023.⁶⁹ The requirements comprehensively incorporate IEEE 2800-2022 clauses, with the exception of Clause 8. Additional information, details, and requirements are also contained in their document with drawings, diagrams, tables, and flowcharts to effectively communicate the requirements to the interconnection customer.
- Duke Energy: Duke has implemented comprehensive IBR-specific interconnection requirements that incorporate IEEE 2800-2022 using the hybrid integration approach around March 2023. The clauses of IEEE 2800-2022 are integrated into a broader set of IBR requirement and clarification and exception are documented thoroughly.⁷⁰ Additionally, Duke has also developed multiple other requirements documents related to IBR risk issues that industry has dealt with over the past decade. These range from IBR plant verification processes to IBR plant commissioning practices, reactive power and primary frequency response capability verifications, post-event data monitoring and collection, and other topics. Duke likely has the most extensive set of IBR-specific requirements that implement and well-exceed IEEE 2800-2022 minimum requirements and most comprehensively address NERC guideline recommendations.⁷¹

Key Findings from Gap Analysis

IBR integration risks are accelerating given past events and the exponential growth of renewables on the system; however, these risks can be addressed to maximize the value that IBR technologies can bring to the BPS moving forward. This gap analysis aimed to evaluate how the industry is working on evaluating and, more importantly, implementing solutions to the IBR risks across the system, specifically working to identify if risk mitigations are being implemented widely and at a pace that matches or exceeds the rapidly growing interconnection of IBRs on the grid.

This analysis highlights that collectively the industry may be struggling to implement risk mitigation measures and solutions in a timely manner that keeps up with the exponential interconnection of IBRs on the system. From the voluntarily adoption and implementation of risk mitigations to regulatory policy efforts that include mandatory reliability standards, both pathways may not be happening at a pace necessary to keep up with the rapidly changing resource mix and grid transformation. NERC guidelines

⁶⁷ https://www.ercot.com/files/docs/2024/07/09/2024_07_ERCOT_IBRWG_ERCOT%20Advanced%20Grid%20Support%20Inverter-

based%20ESRs%20Assessment%20and%20Adoption%20Discussion v1 .pdf

⁶⁸ https://www.nysrc.org/wp-content/uploads/2024/02/RR-151-Procedure-Document-2-9-2024.pdf

⁶⁹ <u>http://www.oasis.oati.com/woa/docs/SOCO/SOCOdocs/SOCO_Inverter-Based-Gen_Interconnection-Technical-Requirements.pdf</u>
⁷⁰ <u>http://www.oasis.oati.com/woa/docs/CPL/CPLdocs/TECP-STD-TFP-00016 - Rev. 001.pdf</u>

¹¹ See the OATI OASIS[®] site (<u>http://www.oasis.oati.com/cpl/index.html</u>) under "Generator Interconnection Information; IBR Interconnection."



were published in 2018 and 2019, and the IEEE 2800-2022 standard was published in 2022, yet in the Western Interconnection there are still many that have yet to implement the recommendations and solutions defined in these publications. The future mandatory NERC reliability standards being developed from FERC Order 901 are still two years away from being fully completed, and six years away from final implementation. Meanwhile, thousands of gigawatts of IBRs are being interconnected in the Western Interconnection.

There are many reasons for these delays in adopting new requirements and risk mitigations. The industry is incredibly busy working to expand the transmission and distribution grid, interconnect new generation resources and loads, upgrade aging infrastructure, and working to operate the bulk power system on a 24/7/365 basis. There will inevitably always be a "lag" by the industry and regulatory bodies in adopting and mandating new risk mitigations due to all the existing workload and limited available resources across the industry, especially among the smaller utilities and cooperatives who are the most resource constrained. However, if we as an industry we do not work to address these lags and improve the speed at which we implement risk mitigations to match the exponential growth and change our system is undergoing, we will continue to see larger and larger risks and events that will significantly impact grid reliability and all customers across the country.

We as an industry need uniformity in our requirements and standards, education/training/guidance for all entities large and small, and move to an overall more proactive approach to our regulatory policies and standards to address emerging risks before they grow to be so large and complex that the reliability of our grid is at risk. <u>CHAPTER 4: *Key Findings and Recommendations*</u> further explores a set of recommendations covering these ideas on how we can collectively work as an industry to move faster in addressing the IBR risks we know now and the future ones coming as the energy transition continues.



CHAPTER 4: Key Findings and Recommendations

While there are many benefits and opportunities that IBR technology brings to the BPS, this assessment highlighted the grid reliability challenges that must be addressed as industry collectively works through the energy transition. IBR-specific reliability challenges are pervasive, spanning grid planning, engineering, and operations. Large-scale grid events around the world illustrate key areas of focus moving forward and the ERO Enterprise continues to strongly emphasize the need for proactive action. FERC has issued multiple directives and the ERO Enterprise is working with industry stakeholders to implement these mandates.

It is critical to not lose sight of the fact that many of the issues being addressed by current regulatory actions are foundational – the need for data sharing, generator ride-through performance, accuracy of modeling and studies, etc. – and may not be adequately addressing more significant systems integration challenges that the sector will face as the energy transition continues. Examples include lower system strength levels, decreasing system inertia, controller interactions challenges, adoption of grid forming (GFM) technology, need for electromagnetic transient (EMT) simulations at-scale, planning and operating with increased uncertainty, grid/resource hardening to extreme weather, and many other issues. Therefore, immediate attention is needed to address these foundational aspects of a reliable BPS from different angles and from a diverse set of stakeholders, so that we may begin working on the even more difficult challenges facing us as the energy transition progresses further.

Recommended WIRAB Advisory Feedback for WECC and the ERO Enterprise

Given WIRAB's advisory role to the ERO Enterprise and FERC, as well as how State public utility commissions (PUCs) can support grid reliability challenges ahead, **Figure 4.1** shows a breakdown of near-term, medium-term, and long-term recommendations based on the assessment completed. WECC and its members, transmission providers (e.g., TOs, ISO/RTOs, etc.), WIRAB and its members, and State PUCs are all key stakeholders for these recommendations.

Near Term 1-2 years	Medium Term 3-4 years	Long Term 2030+
 WECC more directly and closely support industry enhance Facility Interconnection Requirements for IBRs (standardized template for enhancements, ideally implementing IEEE 2800 standard) WECC conduct targeted regional training 	 Proactive stakeholder-engaged risk mitigations by WECC for emerging systems integration challenges for IBRs GFM, oscillations, decreasing system strength and inertia, etc.) WECC support pilot projects for 	The West consider shifting toward regional grid code approach including: Proactively develop risk mitigations ahead of them occurring (leverage WECC studies program) Independently developed and/or stakeholder-driven (by technical
(and engage technical industry with working groups) for IEEE 2800, IBRs, EMT, GFM, and more	emerging IBR risk mitigations (e.g., GFM, EMT, etc.) 3. If no NERC/FERC adoption of IEEE 2800-	group(s)) Technical details defined in code Harmonized across Region Supports smaller entities
 FERC and/or NERC adopt and implement IEEE 2800-2022 in Reliability Standard(s) harmonized requirements for IBR capability and performance 	2022, WECC create a Regional Reliability Standard adopting IEEE 2800-2022 (and future P2800.2) Harmonized West-wide IBR reg's.	Clear compliance obligations and enforcement Flexibility for utility-/system-specific needs allowed Applicable to large loads, VPPs, etc.
 State PUCs emphasize need for proactive enhancement of interconnection requirements (e.g., adopting IEEE 2800- 2022) 		

Key Players in West: WECC (and its members), Transmission Providers (TOs, ISO/RTOs, etc.), WIRAB, State PUCs

Figure 4.1. Near-, Medium-, and Long-Term Recommendations



Near-Term (1–2 Years) Recommendations

Template Facility Interconnection Requirements (WECC): NERC continues to emphasize that enhancements to Facility Interconnection Requirements are strongly recommended to address IBR performance risks. WECC could support transmission providers across the West – both large and small entities – by providing a forum for discussing these enhancements and could even work toward developing a standardized template for IBR-related requirements. This IBR requirements template could include implementation of IEEE 2800-2022 and address any other WECC-specific areas of focus. WECC could issue strong recommendations to its members that this unified IBR requirements template should be implemented across the West based on the work done by WECC and its members. Harmonization of interconnection requirements across the West would help ensure reliability of the BPS while also helping speed up the interconnection process of newly connecting IBRs.

Targeted Stakeholder Engagement on Emerging IBR Topics (WECC): WECC is providing industry education and outreach activities such as its *Reliability in the West* discussion series.⁷² These types of activities help provide general awareness to broad industry stakeholders of the key reliability initiatives and activities underway at WECC, in the West, and within the electricity sector. In addition to these activities, WECC may consider expanding its education, coordination, and outreach activities to support more in-depth engagement with stakeholders that can lead to deliverables that help drive risk mitigation activities. Examples could include:

- **IBR Interconnection Challenges:** Targeted information sharing between grid planners and operators, renewables developers and owner/operators, equipment manufacturers, etc., to better understand the unique challenges facing the interconnection process for Western Interconnection entities.
- Grid Forming Training and Needs: Collaborative discussions and presentations on utility plans for grid forming technology broadly, with detailed presentations on adoption strategies, lessons learned, etc.; presentations from equipment manufacturers to help address transmission planner/provider questions and concerns.
- EMT Modeling and Studies: Focused training and presentations on EMT modeling for IBRs, EMT modeling plans for WECC, EMT model sharing and case creation for future high IBR conditions, and supporting transmission planners overcome immediate EMT-related modeling and study challenges.
- Integrated Resource Planning: Sharing best practices and learnings across resource planners, balancing authorities, reliability coordinators, and utilities; develop key takeaways and recommendations from industry stakeholders to help drive consistent approaches and best practices moving forward.
- Flexibility Metrics and Energy Assurance: Brainstorming, sharing, and developing consistent recommendations regarding how balancing authorities, transmission operators, and reliability coordinators can measure and assess the level of flexibility with existing and future resource mixes, particularly with increasing levels of variable IBRs on the BPS and distributed energy resources (DERs).

⁷² https://www.wecc.org/wecc-document/13931



- Remedial Action Scheme (RAS) Designs & Interactions with IBRs: As highlighted in the risk assessment, RAS designs and interactions are not currently being investigated broadly by the industry as the penetration of IBRs increases. WECC has an opportunity to highlight this risk to the industry at large and facilitate studies and analysis for determining and mitigating any RAS risks associated with IBRs across the system. WECC's RASRS (Remedial Action Scheme Reliability Subcommittee) could take on this activity and bring attention to this potential risk to the reliability of the system.
- System Restoration: Black start studies are performed on a periodic basis today across the industry to update black start system restoration plans as the system is upgraded and changed. However, the future impact of black start system restoration under a grid dominated by IBRs has not been widely analyzed or studied across the system. While the ERO is performing some analysis of black start plans across the Western and Eastern Interconnections, WECC has an opportunity to further evaluate the Western Interconnection black start restoration plans under varying high penetration levels of IBRs in the West. Leading this effort will allow the West to understand how black start plans must evolve and change with a system dominated by IBRs, giving enough time to allow for additional procurements of the necessary resources and equipment to allow for reliable black start system restoration plans.

Harmonized Adoption of IBR Requirements (NERC/FERC): In the near-term, NERC and FERC should seek industry consensus and feedback around how best to adopt IEEE 2800-2022. Both organizations appear to be unwilling to adopt IEEE 2800-2022 directly or by reference and industry has expressed concerns regarding a lack of IBR standards harmonization. Therefore, more industry outreach, engagement, collaboration, and information gathering should be done quickly to identify and constructively define the most effective and efficient path forward. The current FERC Order No. 901 initiatives (e.g., NERC PRC-028, PRC-029, and NERC PRC-030) address only a fraction of the topics covered in IEEE 2800-2022 and with insufficient technical detail.

State Regulatory Emphasis of IBR Requirements Enhancements (State PUCs): In the near term, state utility commissioners and staff can consider the key takeaways and questions outlined in Additional Recommendations for State Commissions below.

Medium Term (3-4 Years) Recommendations

Proactive Stakeholder-Engaged Risk Mitigation (WECC): WECC may consider conducting focused risk mitigation studies with its members using the existing modeling and study resources it has available today. WECC is well-equipped and experienced in conducting WECC-wide reliability studies that explore potential risks or mitigating solutions. This report highlighted the work done by WECC on grid forming, frequency response, etc. To take this one step further, WECC could consider developing a study plan that more thoroughly assesses if *and when* potential new reliability risks will arise in the future.⁷³ Based on the findings of these studies, risk mitigation activities (with engaged stakeholders) can and should be developed well ahead of the risks manifesting. With sufficient time and resources, WECC may seek to proactively develop WECC-specific mitigations (industry efforts, alerts, Regional Reliability

⁷³ Using appropriate engineering judgment and risk-informed decisions making.



Standards, etc.) even if national-level requirements do not keep pace. WECC-specific Standards could always be refined and re-aligned with NERC-level requirements, as needed, in the future.

Pilot Projects for Emerging IBR Risk Mitigations (WECC): WECC may consider more proactive engagement in pilot projects to address emerging IBR risks. For example, it is well understood that increasing IBRs can lead to low system strength stability challenges and will require close screening for when and where to conduct EMT studies. WECC could pilot a small group screening method development activity. Another example could involve implementation of GFM technology on a BESS with close attention to reliability benefits or operational challenges, which could be shared widely with Western stakeholders and could lead to accelerated adoption.

Regional Reliability Standard for Unified IBR Requirements (WECC): While ERO Enterprise Reliability Standards are intended to ensure an adequate level of reliability with minimal compliance burden, it is important that they remain system-specific and sufficiently agile to keep pace with the rapid change upon the electricity sector in the coming decades. Unification and harmonization may not be possible at the ERO level (or may not be agile enough); therefore, WECC may consider highrisk areas where more targeted WECC-centric Regional Reliability Standards may be needed moving forward. System inertia challenges and fast frequency response, EMT model data sharing across TPs and PCs, low system strength conditions and GFM adoption, IBR commissioning, offshore wind, and many other areas may actually benefit from standardized approaches and requirements that actually streamline processes and practices rather than hinder industry stakeholders.

Long-Term (2030+) Recommendations

Transitioning Toward a Grid Code Approach in the West: Overhauling the entire BPS regulatory framework nationally would be nearly insurmountable without some form of catastrophic failure. However, less drastic shifts in the regulatory process could result in tangible benefits from a regulatory oversight perspective. There are high-level learnings that one can glean from comparing the current performance-based Reliability Standards approach used in North America with other electricity regulatory frameworks around the world such as ENTSO-E and other regions.⁷⁴ For example, performance based Reliability Standards are almost entirely industry stakeholder-driven unless mandated by FERC (which tends to lag serious reliability risks significantly), resulting in regulatory lag and general trends toward regulating issues that only the supermajority is dealing with presently or in the near-term. On the other hand, a grid code approach has an independent body developing regulations, codes, and requirements in consultation with industry and with oversight from an additional governing body. Similarly, the Reliability Standards are not effective until after commercial operation (the FERC GIA and GIP govern rules prior to interconnection), which leaves a chasm of regulatory attention during generator interconnection, commissioning, and into commercial operation. With a grid code approach, the detailed rules are well established and demonstration of compliance with those rules is an obligation to achieve commercial operation. Table 4.1 highlights some of the key differences between these regulatory approaches.

⁷⁴ https://www.entsoe.eu/



Table 4.1. Key Differences between Regulatory Approaches						
Category	Performance-Based Standard Approach	Grid Code Approach				
Compliance and enforcement	Compliance program-oriented; cyclical audits of practices and controls; financial penalties; enforcement and monitoring start after interconnection	Focused on results and actual performance; enforcement against documented proof of compliance (verification); starts during interconnection process; stringent accountability				
Technical depth and breadth	Generally relatively high-level, process-oriented requirements; technical details left to registered entities to define	Technical details contained in code with local flexibility to modify as needed (with oversight)				
Technology differences	Historically technology-agnostic; evolving practices in this area	Technological-specific requirements clearly defined				
Risk priorities and focuses	Mostly known, past, or observed risks; relatively minimal focus on future risks	Defines conditions for accessing the electricity grid; contained set of obligations to entities				
Agility	Stakeholder misalignment of risk prioritization can cause delays or inaction	Stakeholder engagement can delay action; independent				
Requirements development	Small set of nominated stakeholders develop draft standards, seek industry consensus	Independent body drafts codes & guidelines in close collaboration & consultation with industry experts & stakeholders; oversight by governing bodies				
Structure and applicability	Entity applicability spread across dozens of standards	Entity applicability (e.g., generators or large loads) contained within one network code ⁷⁵				
Policy alignment	No direct alignment between standards and energy policies, leading to potential risks	Governing body reviews draft standards to ensure energy policy objectives are met				

Additional Recommendations for State Commissions

Many of the IBR challenges and risks presented are within FERC and NERC jurisdiction regarding generator interconnection procedures and agreements, administering the open access transmission tariff, and establishing TO Facility Interconnection Requirements per NERC FAC-001. However, State utility commissioners can play a pivotal role in helping drive meaningful enhancements in this area. Recommendations of how State commissioners can engage in this discussion include:

Advocate for Enhanced and Harmonized Transmission Owner Interconnection Requirements: Commissioners should engage with utility (TO) constituents within their state about what IBRspecific interconnection requirement enhancements are being made *proactively* to address the rapidly rising IBR levels. These efforts should not be reactive; rather, they should be proactive to prepare for growing levels of IBRs. The recommended place to house technical interconnection requirements is in the TO FIRs rather than the power purchase agreements (PPAs) or other contracts. Relying on the FERC GIA/GIP alone and/or the NERC Reliability Standards may not provide sufficient requirements for IBR plant design decisions, which could lead to unexpected risks. Further, commissioners may consider advocating for streamlined and effective IBR plant commissioning practices to ensure data sharing and unified understanding of IBR plant design and as-built setting which can help all involved parties support a more reliable and resilient BPS.

• Inquire About and Support Adoption of IEEE 2800-2022: State commissioners can help drive utility adoption and implementation of IEEE 2800-2022 in their interconnection requirements,

⁷⁵ <u>https://www.entsoe.eu/network_codes/</u>



which supports a harmonized approach for IBR interconnections. These requirements are comprehensive and cover nearly all the IBR risks posed across Interconnections in North America reported by NERC thus far. Technical requirements should be included in TO FIRs; however, additional high-level requirements should also be included in utility request for proposals (RFPs) for new resources or included in discussions for utility integrated resource/system plans (IRPs/ISPs).

Promote Coordination Between State and Federal Authorities: Commissioners can encourage improved coordination and alignment between state regulatory bodies and FERC by engaging in collaborative discussions with FERC and regional transmission organizations (RTOs)/independent system operators (ISOs), and utilities. State commissioners can ensure that state-level concerns and objectives are considered in the federal rulemaking process, which includes impacts to their utility constituents. State commissioners advocating for national harmonization and uniformity will help drive those aspects at the FERC and NERC level rather than relying on each individual TO to develop their own IBR requirements.

Encourage and Support Utility Investment in Grid Modernization: Commissioners should understand that the variable and uncertain nature of the current and future system will necessitate utility investments in grid infrastructure such as FACTS devices, advanced protection and control systems, and long-term transmission upgrades. Additionally, advanced modeling, studies, and analyses may be needed as part of large capital projects. By supporting and approving investments in new and advanced grid technologies, commissioners can help create a more reliable, resilient, and flexible grid of the future to handle high IBR conditions.

Support Streamlining of Interconnection Processes: Commissioners should advocate for and implement measures that streamline the interconnection process for generators, reduce unnecessary delays, and avoid administrative burdens. A big part of streamlining is ensuring that only credible projects are introduced into the interconnection queue. Commissioners may engage with utilities regarding how they seek to optimize the interconnection queue for credible projects and avoid speculative projects while meeting the obligations and directives of FERC Order No. 2023. Are utilities building any technical rigor into the first-ready, first-served approach (e.g., selection of plant equipment, IBR plant designs, etc.)? Commissioners should also understand that technical rigor (modeling and study work) is necessary to ensure accurate decisions are made for grid reliability purposes. A delicate balance between speed of interconnection and technical rigor is necessary. These same concepts also apply to the load interconnection requests, particularly with the growing prevalence of large data centers and industrial loads in many areas.

(i) Stay Informed on Active Industry Efforts in This Area: Commissioners and their staffs can remain educated and informed on these initiatives by staying involved in industry workshops, conferences, webinars, hearings, and other collaborative forums being held by FERC, NERC, IEEE, DOE, and other industry trade organizations. Education initiatives can also raise awareness about the benefits of robust and uniform interconnection standards.

These actions can help state utility commissioners play a proactive role in enhancing interconnection requirements and contributing to a more reliable and resilient bulk power system.

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Western Interconnection Compliance Forum (WICF)

Layna McVay, WICF Chair Reliability Compliance Manager Grant PUD Lmcvay@gcpud.org

WWW.WICF.BIZ



- WICF's purpose
 - Encourage registered entities within the Western Interconnection to share knowledge, share lessons learned, and develop compliance best practices
- Outreach to members
 - Workshops and breakouts, in conjunction with WECC R&S Workshops
 - Focus Groups
 - Town Hall sessions and peer share events
- Ongoing collaboration with WECC

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Board of Directors Meeting Approval Item WECC Long-term Strategy December 11, 2024

Board Resolution

Resolved, that the WECC Board of Directors (Board), acting at the meeting of the Board on December 11, 2024, approves the WECC Long-term Strategy as presented and attached.

Background

WECC has spent the past 10 months developing a revised draft Long-term Strategy (LTS). The draft LTS builds upon the LTS approved by the Board in September 2020 and demonstrates WECC's commitment to taking the actions necessary to ensure that WECC remains the independent, interconnection-wide voice of reliability in the Western Interconnection.

The draft LTS was the topic at the September 18, 2024, Interactive Session, where feedback was provided by stakeholders. Separate comments were received and considered through the Member Advisory Committee (MAC), Western Interconnection Regional Advisory Body, and the Board. The LTS was posted for public comment from October 10 to November 5, 2024, where no additional comments were received.

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DRAFT Long-Term Strategy December 11, 2024

Introduction

Our "Why"

Electricity is an essential part of the fabric of modern life. WECC strengthens that fabric to preserve and improve society's future. Our "why" is at the heart of all we do, because we know what happens when the power goes out—gas systems fail, water pumps cease to operate, communication networks shut down, emergency services are impaired, economies are affected, people panic, and lives are lost.

The Western Interconnection is a complex system of interconnected generation, transmission, and distribution that provides reliable electric services to over 90 million people in all or part of 14 states, two Canadian provinces, and parts of Baja, Mexico. The system is owned and operated by various investor-owned utilities, public power utilities, municipal utilities, co-ops, and power marketers while being subject to the authority and oversight of state and provincial regulators, state energy offices and, ultimately, actions by state and provincial lawmakers. The Western Interconnection is at the forefront of development of many new energy resources. Energy policies vary significantly from state to state and province to province, and the extremes of all types of weather are felt across its expansive footprint.

The Western Interconnection is also changing at a magnitude and pace that is unparallelled. Those who plan, operate, and care about the reliability of the interconnection must confront challenges more frequently—increasingly recurrent extreme natural events, large-scale generator retirements to meet aggressive clean energy goals, massive amounts of new generators that present new technological and dispatchability challenges, evolving and increasing cyber- and physical threats, the risks and opportunities posed by artificial intelligence, rapidly changing demand brought about by electrification, and the proliferation of data centers and other technologies, with their accompanying large loads. In short, change is affecting everything, everywhere, all at once.

WECC, as the only entity in the West with an Interconnection-wide view, occupies a crucial place within the Interconnection. With our focus solely on reliability, WECC serves as the Western Interconnection's independent, interconnection-wide voice of reliability. To ensure we are a trusted partner in the future and to fulfill our mission to effectively and efficiently mitigate risks to the reliability and security of the Western Interconnection's Bulk Power System, we must continue to elevate our organizational health and performance.

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The ERO Enterprise



We are unified in our reliability and security Mission with NERC, the Electric Reliability Organization, (ERO) and the other Regional Entities of the ERO Enterprise.¹ NERC and the Regional Entities play different, but important and complementary, roles. NERC provides industry-wide perspective and oversight, while the Regional Entities have features and activities that serve the needs of their regional constituents. The partnership between NERC and the Regional Entities is critical to the success of the ERO Enterprise. As an ERO Enterprise, we are committed to:

- Working together as one team and honoring each of our roles;
- Actively supporting ERO Enterprise activities while eliminating unnecessary duplication of work;
- Collaborating in developing clear and consistent guidance across the ERO Enterprise;
- Sharing information, knowledge, and resources across the ERO Enterprise;
- Developing and sharing harmonized messages across ERO Enterprise communications; and
- Supporting innovation, initiative, and the sharing of best practices across the ERO Enterprise.

At WECC, our Long-Term Strategy with its five Impact Areas deliberately aligns with the ERO Enterprise Long-Term Strategy and its four Focus Areas.

The Independent Voice of Bulk Power System Reliability in the Western Interconnection

WECC is a non-profit, public interest organization dedicated to promoting the reliability and security of the Western Interconnection. As the Regional Entity in the West with delegated authority to perform

¹ In 2006, NERC was designated as the North American ERO following the Great Northeast Blackout of 2003. NERC has statutory authority to adopt and enforce reliability standards for the North American Bulk Power System. NERC has delegated some of its enforcement authority to six regional entities: WECC, Reliability First, Texas RE, SERC, NPCC, and MRO. These regional entities, together with NERC, constitute the so-called "ERO Enterprise."



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critical reliability and security functions, WECC has a unique value proposition that promotes reliability through three principles: Independence, Perspective, and Partnership.



- **Independence**: Our diverse body of stakeholders look to and rely upon us as the impartial and unbiased voice on matters that affect reliability in the Western Interconnection. We deliver relevant insight and sometimes difficult messages necessary to address and mitigate risks to the grid. Our analytical, oversight, and study work support and reinforce our independent approach.
- **Perspective**: We develop comprehensive and influential work products that support reliability and security. As the only entity in the West with an interconnection-wide view, our perspective and role allow us to collect and analyze a wide variety of data which assists in identifying and mitigating broad risks to reliability and security.
- **Partnership**: Our commitment to a reliable bulk power system requires active engagement with users, owners, and operators of the BPS. We collaborate and coordinate across a wide array of stakeholders to identify, evaluate, and reduce risks to the reliability and security of the Western Interconnection. Maintaining credibility with industry, policymakers, government entities, regional bodies, interested stakeholders, and the ERO Enterprise is the key to successfully achieving our mission.

Impact Areas

Our strategy focuses on five identity-centric Impact Areas that promote a future in which we continue to realize our vision of a reliable and secure bulk power system in the Western Interconnection.

- 1. **Risk Mitigation**: We are an organization aligned around risk reduction. Our holistic risk-based approach uses all the tools and skills available to deliver comprehensive risk mitigation strategies.
- 2. **Partnership**: We are sought after as a partner to address the risks that pose the greatest threat to reliability. We identify concerns and facilitate solutions with input and assistance from diverse



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and often conflicting stakeholder perspectives, focusing our resources on risks that pose the greatest threat to reliability and security.

- 3. **Perspective**: Our insights, analyses, and outreach promote industry action. We are renowned for providing clear and actionable communications supported by data and rigorous analysis.
- 4. **Independence**: Our resource- and technology-neutral, interconnection-wide perspective is respected and trusted to allow decision-makers to rely on WECC as an independent partner.
- 5. People: Our highly skilled and engaged employees are champions for reliability.

Detail on each of these Impact Areas follows.

Impact Area 1

Risk Mitigation: We are an organization aligned around risk reduction. Our holistic riskbased approach uses all the tools and skills available to deliver comprehensive risk mitigation strategies.

We will develop cohesive, well-coordinated strategies to identify and mitigate risks to reliability and security that are effective and leverage all the tools at our disposal. To ensure that our risk-based approach will meet the reliability and security challenges facing the Western Interconnection, we will:

- Work collectively from, orient around, and live by a single, company-wide register of risks that drives a holistic, coordinated, comprehensive, one-WECC mindset and approach to identifying, prioritizing, and mitigating reliability and security risks.
- Use effective and coordinated implementation of resources (e.g., oversight, event analysis, reliability assessments, outreach, strategic engagement, internal and external relationships, training, etc.) and skills across the organization in support of identifying and reducing risks to reliability.
- Create an environment where industry participants in the Western Interconnection focus on how to proactively identify and mitigate risks to reliability and security as opposed to focusing solely on compliance risk.

Impact Area 2

Partnership: We are sought after as a partner to address the risks that pose the greatest threat to reliability. We identify concerns and facilitate solutions with input and assistance from diverse and often conflicting stakeholder perspectives, focusing our resources on risks that pose the greatest threat to reliability and security.

We will create an environment and framework in which stakeholders share their known and emerging reliability risks with us and seek to partner with us to address their related needs and concerns, actively engage in our oversight and risk identification programs; gather and share impact data and relevant considerations related to the identified risks; and implement collectively identified risk-



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mitigation strategies. To ensure we are a sought-after partner to help address reliability and security challenges in the Western Interconnection, we will:

- Develop a stakeholder engagement model that preserves our interconnection-wide view and that enables our stakeholders to collaborate with us in a way that strengthens our independence, enabling us to perform world-class monitoring and oversight and to produce timely, relevant work that informs reliability and security in the Western Interconnection.
- Leverage the unique perspective that we have as both a regulator and a partner to ensure that our stakeholders rely upon and value us.
- Collaborate and prioritize our resources and work across WECC to foster the necessary partnership and coordination with stakeholders that maximizes our impact on the most important reliability topics, while ensuring we do not expend resources on low-impact or unnecessary activities.

Impact Area 3

Perspective: Our insights, analyses, and outreach drive industry action. We are renowned for providing clear and actionable communications supported by data and rigorous analysis.

We will produce products that are relied upon by our broad range of stakeholders in the Western Interconnection as authoritative sources to inform conclusions and resulting actions. To ensure that our communications and publications are celebrated by their targeted audiences for being timely, clear, and compelling we will:

- Enhance existing and create new modes of training, outreach, and communication.
- Use the latest technologies and tools available to acquire the data we need, to understand and analyze that data, and to manage the data in an exemplary manner.
- Produce communications and publications that are technically rigorous while being tailored to their intended recipients and are timely delivered to the stakeholders who need them.

Impact Area 4

Independence: Our resource- and technology-neutral, interconnection-wide perspective is respected and trusted to assure decision-makers that they have an independent partner to rely on.

We will work to be a critical partner in discussions that affect reliability and security across the interconnection. Decision-makers will use our information to support decisions being made within their jurisdictions to the benefit of reliability and security. To be the trusted and critical partner decision-makers rely on in the Western Interconnection we will:



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- Produce publications, insights, and other communications that address the most significant reliability and security risks in the Western Interconnection, thereby empowering decision-makers in the West to make decisions that have reliability as a priority.
- Develop products that speak to and across multiple audiences. Everything we develop and produce will consider the needs and perspectives of the stakeholder(s) or stakeholder group(s) for whom those products are intended.
- Maintain and promote our neutrality and singular focus on reliability to create a space where decision-makers can share their diverse perspectives to address the most significant reliability issues.

Impact Area 5

People: Our highly skilled and engaged employees are champions for reliability.

Our employees will seek us out and remain with us because they are passionate about our Vision and Mission, our culture, and opportunities to develop and perform work that matters. Our employees will continuously increase their value as trusted partners who produce high quality, credible, and influential work. Our employees will be engaged, highly skilled, dedicated to continuous improvement, and want to be part of an organization that is taking on the most significant reliability issues because we will:

- Intentionally connect all our employees to our Vision, Mission, and culture through our workforce engagement model.
- Create a culture where we trust each other and are empowered and accountable to challenge the status quo, embrace change, and elevate and celebrate our contributions.
- Focus on professional development and knowledge transfer to build cross-functional teams, to provide development opportunities to employees, and ensure that we have the bench strength to fulfill our mission.

Conclusion

Electricity is an integral part of the fabric of modern life. Our reliability and security vision and mission are crucial for preserving the strength of that fabric. In the increasingly complex and rapidly changing landscape of the Western Interconnection, we embrace our role as the independent voice of Bulk Power System reliability in the Western Interconnection by adopting this Long-Term Strategy.



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<Public>

Long-term Strategy

December 11, 2024

Jeff Droubay VP & General Counsel



<Public>

Revised Long-term Strategy

- WECC has been working since March 2024 to review and revise its Long-term Strategy (LTS).
- At the September Board and Annual Meetings, we presented an initial draft LTS and sought feedback from the Board and WECC's membership. We revised the LTS considering the feedback received.
- In October, the draft LTS was posted on wecc.org for public comment.
 We received comments from the MAC and WIRAB and have revised the draft LTS to address the comments we received.
- We are seeking Board approval of the draft LTS today.

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2
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WECC Board of Directors Finance and Audit Committee

Verbal Update

Richard Woodward, Chair

December 11, 2024



Board of Directors Meeting Approval Item Finance and Audit Committee Charter December 11, 2024

Board Resolution

Resolved, that the WECC Board of Directors (Board), acting on the recommendation of the Finance and Audit Committee (FAC) at the meeting of the Board on December 11, 2024, approves the FAC Charter as presented and attached.

Background

A clean and redlined version of the proposed FAC Charter are included in the Board package. Initial review of the charter was performed by WECC legal with a subsequent review by the FAC and a recommendation for Board approval expected at the December 10, 2024 FAC meeting.

Proposed revisions are as follows:

- Remove language on assigning staff to prepare meeting minutes;
- Clarification on how the FAC may participate in a meeting;
- Updates to meeting notices, materials posting, and approval requirements;
- Add language for the chair to permit any Director to monitor closed sessions; and
- Changing the charter review requirement to "as needed but at least biennially."



Finance and Audit Committee Charter

Establishment and Authority

The Finance and Audit Committee (FAC) was established by the Board of Directors (Board).

Purpose and Responsibilities

The purpose of the FAC is to report to and assist the Board by providing oversight of financial management, independent auditors, and financial reporting procedures, as well as such other matters as directed by the Board or this charter.

To carry out its oversight responsibilities, the FAC will perform the following functions.

1. Oversight of WECC's financial reporting

The FAC will review with management and the external auditors:

- o The audited financial statements, including the notes to the financial statements.
- Changes in accounting policies and practices, and significant judgments that may affect financial results.
- The nature of any unusual or significant commitments or contingent liabilities, together with the underlying assumptions and estimates of management.
- Any changes of accounting standards that may materially affect financial reporting practices.
- The quality and adequacy of WECC's internal financial controls structure.

2. Oversight of WECC's financial reporting compliance

- a. The FAC will review and monitor:
 - Litigation or other legal matters that could have a significant impact on financial results.
 - Significant findings of any examination by regulatory authorities or agencies, in the areas of securities or accounting.
- b. The FAC will ensure procedures have been established for the receipt, retention, and treatment
 of complaints from employees on accounting, internal accounting controls, or auditing matters.
 This includes the confidential, anonymous submissions by employees of concerns regarding
 questionable accounting or auditing matters. Management will notify the FAC when any such
 complaints are received and the FAC will review management's recommended resolution of the
 matter.
- c. The FAC is responsible for overseeing the conduct of management in carrying out its responsibility for preparing financial statements and the independent auditors for auditing

FAC Charter

these financial statements. Consequently, in carrying out its oversight responsibilities, the FAC is not providing any expert or special assurance about financial statements or any professional certification about the independent auditors' work.

3. Oversight of WECC's independent auditors

- a. The FAC will:
 - Have the ultimate authority and responsibility to appoint, retain, compensate, evaluate, and when appropriate, terminate the business relationship with the external auditors. This responsibility includes resolving disagreements between management and the independent auditors regarding financial reporting. The FAC will oversee the qualifications and independence of the external auditors and perform a triennial review of the independent auditors' performance.
 - Review and approve the scope of the annual independent audit of financial statements and the associated engagement fees, as well as any significant variations in the actual scope of the independent audit and the associated engagement fees.
 - Review with the independent auditors any difficulties the auditors encountered during the audit—including restrictions on the scope of work or access to requested information—and any significant disagreements with management.
 - Ensure the receipt of a formal written statement from the external auditors affirming their independence from WECC.
 - Oversee the expedient implementation of corrective actions resulting from an audit.
- b. Throughout its oversight of the independent auditors as provided under this charter, the FAC will be guided by the premise that the independent auditors are ultimately accountable to the FAC.

4. Oversight of WECC's annual Business Plan and Budget process

- a. The FAC will review and monitor:
 - Performance against the approved budget on a quarterly basis.
 - Management's schedule for the preparation and development of the annual Business Plan and Budget and any supplemental budgets to ensure that the schedule provides sufficient time for the development of the budget, a review by the FAC, input from stakeholders, and approval of the final Business Plan and Budget by the Board.



5. Oversight of WECC Guidelines, Policies, and Processes

- a. The FAC will ensure that:
 - The guidelines, policies, and processes relied on and used by management to assess and manage enterprise risk are discussed by the full Board annually.
 - The Investment Policy Statement is reviewed annually.
 - The Reserve Policy, including the appropriate level of reserves, is reviewed annually.

Committee Composition and Governance

1. Membership

- a. The FAC will comprise no less than four members of the Board, appointed by the chair of the Board, and in consultation with the Board.
- b. The FAC members will serve until a successor is appointed unless the member resigns or is removed by the Board. In the case of a vacancy, the chair of the Board will fill the position.
- c. The FAC members will perform a biennial self-evaluation.

2. Leadership

- a. The chair of the Board, in consultation with the Board, will appoint one of the FAC members to serve as the FAC's chair.
- b. The chair will manage the committee and its meetings.
- c. The chair may appoint a steering committee to address specific assignments as necessary.
- d. The chair will assign the duties of the chair to any member of the FAC in the event of the chair's absence.

3. Meetings

- a. The FAC will meet at least two times per year or as often as required to carry out its responsibilities. Meetings will be held according to the <u>Meeting Policy</u> and may be in person or by telephone or web conference, as determined by the chair.
- b. A quorum for meetings will be a majority of committee members.
- c. Action taken by the FAC will require a majority vote of the FAC members present. Voting may be by any means the chair determines appropriate. FAC members may not vote by proxy or absentee ballot, but FAC members may participate in meetings, including casting votes, by telephone conference or any other means of communication that enables all members participating in a meeting to simultaneously hear one another.
- d. Email notice of the time and place of all meetings will be provided to each member of the FAC and to the Board no later than three days before the meeting, or upon as much notice as is reasonable under the circumstances as approved by a majority of FAC members. An agenda, including identification of the items for which action may be taken, will be provided with the



FAC Charter

meeting notice. Notice of meetings and the agenda will also be posted on the WECC website. Approval item documents should also be posted in advance of the meeting, when possible, but documents approved by the FAC may differ from what is posted.

e.

- f. The FAC may meet in closed session to -
 - Consider the employment, evaluation of performance, or dismissal of an employee;
 - Discuss pending or proposed litigation and to receive confidential attorney-client communications from legal counsel; and
 - Receive and discuss any information that is privileged, trade secret, cybersecurity, critical energy infrastructure information (as defined by the Federal Energy Regulatory Commission), protected from public disclosure by law, or that the committee determines should be confidential to protect a legitimate public interest.

The FAC chair will permit any Director to monitor such closed sessions, except those Directors who are conflicted in accordance with section 7.6.1.1 of WECC's Bylaws or where the FAC determines that a Director has a perceived or actual conflict of interest.

Reporting

The FAC will report to the Board on its activities and any recommendations for Board action.

Review and Changes to the Charter

The FAC will review this charter as needed but at least biennially and recommend any changes to the Board for approval.

Approved by the WECC Board of Directors: December 11, 2024



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Finance and Audit Committee Charter

Establishment and Authority

The Finance and Audit Committee (FAC) was established by the Board of Directors (Board).

Purpose and Responsibilities

The purpose of the FAC is to report to and assist the Board by providing oversight of financial management, independent auditors, and financial reporting procedures, as well as such other matters as directed by the Board or this charter.

To carry out its oversight responsibilities, the FAC will perform the following functions.

1. Oversight of WECC's financial reporting

- a. The FAC will review with management and the external auditors:
- The audited financial statements, including the notes to the financial statements.
- Changes in accounting policies and practices, and significant judgments that may affect financial results.
- The nature of any unusual or significant commitments or contingent liabilities, together with the underlying assumptions and estimates of management.
- Any changes of accounting standards that may materially affect financial reporting practices.
- o The quality and adequacy of WECC's internal financial controls structure.

2. Oversight of WECC's financial reporting compliance

- a. The FAC will review and monitor:
 - o Litigation or other legal matters that could have a significant impact on financial results.
 - Significant findings of any examination by regulatory authorities or agencies, in the areas of securities or accounting.
- b. The FAC will ensure procedures have been established for the receipt, retention, and treatment of complaints from employees on accounting, internal accounting controls, or auditing matters. This includes the confidential, anonymous submissions by employees of concerns regarding questionable accounting or auditing matters. Management will notify the FAC when any such complaints are received and the FAC will review management's recommended resolution of the matter.
- c. The FAC is responsible for overseeing the conduct of management in carrying out its responsibility for preparing financial statements and the independent auditors for auditing

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FAC Charter

these financial statements. Consequently, in carrying out its oversight responsibilities, the FAC is not providing any expert or special assurance about financial statements or any professional certification about the independent auditors' work.

3. Oversight of WECC's independent auditors

- a. The FAC will:
 - Have the ultimate authority and responsibility to appoint, retain, compensate, evaluate, and, when appropriate, terminate the business relationship with the external auditors. This responsibility includes resolving disagreements between management and the independent auditors regarding financial reporting. The FAC will oversee the qualifications and independence of the external auditors and perform a triennial review of the independent auditors' performance.
 - Review and approve the scope of the annual independent audit of financial statements and the associated engagement fees, as well as any significant variations in the actual scope of the independent audit and the associated engagement fees.
 - Review with the independent auditors any difficulties the auditors encountered during the audit—including restrictions on the scope of work or access to requested information—and any significant disagreements with management.
 - Ensure the receipt of a formal written statement from the external auditors affirming their independence from WECC.
 - o Oversee the expedient implementation of corrective actions resulting from an audit.
- b. Throughout its oversight of the independent auditors as provided under this charter, the FAC will be guided by the premise that the independent auditors are ultimately accountable to the FAC.

4. Oversight of WECC's annual Business Plan and Budget process

- a. The FAC will review and monitor:
 - Performance against the approved budget on a quarterly basis.
 - Management's schedule for the preparation and development of the annual Business Plan and Budget and any supplemental budgets to ensure that the schedule provides sufficient time for the development of the budget, a review by the FAC, input from stakeholders, and approval of the final Business Plan and Budget by the Board.



FAC Charter

5. Oversight of WECC Guidelines, Policies, and Processes

- a. The FAC will ensure that:
 - The guidelines, policies, and processes relied on and used by management to assess and manage enterprise risk are discussed by the full Board annually.
 - o The Investment Policy Statement is reviewed annually.
 - o The Reserve Policy, including the appropriate level of reserves, is reviewed annually.

Committee Composition and Governance

1. Membership

- a. The FAC will comprise no less than four members of the Board, appointed by the chair of the Board, and in consultation with the Board.
- b. The FAC members will serve until a successor is appointed unless the member resigns or is removed by the Board. In the case of a vacancy, the chair of the Board will fill the position.
- c. The FAC members will perform a biennial self-evaluation.

2. Leadership

- a. The chair of the Board, in consultation with the Board, will appoint one of the FAC members to serve as the FAC's chair.
- b. The chair will manage the committee and its meetings.
- c. The chair will assign a committee member or WECC staff member to prepare minutes of FAC meetings for the committee's approval.
- d. The chair may appoint a steering committee to address specific assignments as necessary.
- e. The chair will assign the duties of the chair to any member of the FAC in the event of the chair's absence.

3. Meetings

- a. The FAC will meet at least two times per year or as often as required to carry out its responsibilities. Meetings will be held according to the <u>Meeting Policy</u> and may be in person or by telephone or web conference, as determined by the chair.
- b. A quorum for meetings will be a majority of committee members.
- c. Action taken by the FAC will require a majority vote of the <u>FAC</u> members present. Voting may be by any means the chair determines appropriate. FAC members may not vote by proxy or absentee ballot, <u>but FAC members may participate in meetings, including casting votes, by telephone conference or any other means of communications that enables all members participating in a meeting to simultaneously hear one another.</u>
- d. The chair (or designee) will give notice by eEmail notice of the time and place of all meetings will be provided to each member of the FAC and to the Board no later than three days before



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FAC Charter

the meeting, or upon as much notice as is reasonable under the circumstances as approved by a majority of FAC members. An agenda, including identification of the items for which action may be taken, will be provided with the meeting notice. Notice of meetings and the agenda will also be posted on the WECC website. of the time and place for all meetings and will post notice of all meetings on the WECC website. Notice will be given at least three business days before each meeting. Approval item documents should also be posted in advance of the meeting, when possible, but documents approved by the FAC may differ from what is posted.

- e. An agenda containing the items for which action may be taken will be posted on the WECC website at least three business days before each meeting.
- f. The FAC may meet in closed session to
 - o Consider the employment, evaluation of performance, or dismissal of an employee;
 - Discuss pending or proposed litigation and to receive confidential attorney-client communications from legal counsel; and
 - Receive and discuss any information that is privileged, trade secret, cybersecurity, critical energy infrastructure information (as defined by the Federal Energy Regulatory Commission), protected from public disclosure by law, or that the committee determines should be confidential to protect a legitimate public interest.

The FAC chair will permit any Director to monitor such closed sessions, except those Directors who are conflicted in accordance with section 7.6.1.1 of WECC's Bylaws or where the FAC determines that a Director has a perceived or actual conflict of interest.

Reporting

The FAC will report to the Board on its activities and any recommendations for Board action.

Review and Changes to the Charter

The FAC will review this charter annually as needed but at least biennially and recommend any changes to the Board for approval.

Approved by the WECC Board of Directors: September 13, 2023



4

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WECC Board of Directors

Governance Committee

Verbal Update

Ian McKay, Chair

December 11, 2024



Board of Directors Meeting Approval Item Governance Committee Charter December 11, 2024

Board Resolution

Resolved, that the WECC Board of Directors (Board), acting on the recommendation of the Governance Committee (GC) at the meeting of the Board on December 11, 2024, approves the GC Charter as presented and attached.

Background

A clean and redlined version of the proposed GC Charter are included in the Board package. Initial review of the charter was performed by WECC legal with a subsequent review by the GC and a recommendation for Board approval expected at the December 10, 2024 GC meeting.

Proposed revisions are as follows:

- Minor editorial changes include removing the date of the Bylaws, changing "interface" to "cooperate," capitalization corrections, and general grammar/wording updates;
- Creating a list requiring biennial review of the Board of Directors Principles of Corporate Governance, Standards of Conduct, and Responsibility and Accountability Matrix;
- Remove language on assigning staff to prepare meeting minutes;
- Clarification on voting requirements and meeting participation;
- Updates to meeting notices, materials posting, and approval requirements for both open and closed sessions; and
- Changing the charter review requirement to "as needed but at least biennially."



Governance Committee Charter

Establishment and Authority

The Governance Committee (GC) is a Board committee established under Section 8.3 of the WECC Bylaws.

Purpose and Responsibilities

The purpose of the GC is to help the WECC Board of Directors (Board) be highly effective and the entire organization to be well-governed.

The committee's primary duties and responsibilities are as follows:

- 1. Oversee implementation and amendment of the Bylaws.
- 2. Cooperate with the Western Interconnection Regional Advisory Body on governance matters.
- 3. Cooperate with the Member Advisory Committee on governance matters.
- 4. Review and update the following documents as needed but at least biennially:
 - Board of Directors Principles of Corporate Governance;
 - Standards of Conduct (for Board Directors and for Officers and Employees); and
 - Responsibility and Accountability Matrix.
- 5. Ensure that all Board policies and charters are reviewed regularly and are up to date and relevant. In this task, the GC is assisted by the corporate secretary, who will provide an annual report on the status of these reviews.
- 6. Discuss education and development opportunities for Board members, including as informed by the Board and Board committee self-assessment process.
- 7. Evaluate biennially in the off years when no evaluation is occurring the thoroughness and effectiveness of the Board and Board committee self-assessment process.
- 8. Make recommendations to assist the Board in making decisions under Bylaws Sections 6.5.2 (removal of Directors) and 6.7.3 (appointment of temporary Directors).
- 9. Perform such other functions pertinent to governance as may be delegated by the Board.

Committee Composition and Governance

1. Membership

Governance Committee Charter

- a. The GC will be composed of at least three members of the Board, appointed by the chair of the Board in consultation with the Board.
- b. Each member of the GC will serve until a successor is appointed unless the member resigns or is removed by the Board. If a vacancy occurs at any time, the Board chair may fill that vacancy.
- c. No member of the GC may participate as a GC member at any time that the GC may consider any recommendation to the Board that would directly affect the continued service of that Director as a member of the Board of Directors. The Board chair may appoint a temporary, alternate member to serve on the GC in place of any Director who is recused from participation under this paragraph.

2. Leadership

- a. The chair of the Board, in consultation with the Board and with consideration of a Director's interest and expertise, will appoint one GC member to serve as the GC chair.
- b. The GC chair will manage the GC and its meetings.
- c. The GC chair may appoint a steering committee to address specific assignments as necessary.

3. Meetings

- a. The GC will meet a minimum of twice per year and as often as required to carry out its responsibilities. Meetings will be held in accordance with the WECC Meeting Policy and may be in person or by telephone or web conference as determined by the chair.
- b. The GC will determine the procedures for its meetings, except:
 - i. A quorum for meetings is a majority of members of the committee.
 - ii. Actions or decisions taken by the GC require an affirmative vote of a majority of GC members present.
 - iii. GC members may not vote by proxy or absentee ballot, but GC members may participate in meetings, including casting votes, by telephone conference or any other means of communications that enables all members participating in a meeting to simultaneously communicate with each other.
- c. Email notice of the time and place of all meetings will be provided to each member of the GC and to the Board no later than three days before the meeting, or upon as much notice as is reasonable under the circumstances as approved in writing by a majority of GC members. An agenda, including identification of the items for which action may be taken, will be provided with the meeting notice. Notice of meetings and the agenda will also be



Governance Committee Charter

posted on the WECC website. Approval item documents should also be posted in advance of the meeting, when possible, but approvals by the GC may differ from what is posted.

d. The GC chair may call for a closed session of the GC for the reasons set forth in sections 7.6.1-1), 2), and 3) of WECC's Bylaws. The GC chair will permit any Director to monitor such closed sessions except those Directors who are conflicted in accordance with sections 7.6.1.1. of the Bylaws or where the GC determines that a Director would have a perceived or actual conflict of interest.

Reporting

The GC will report to the Board on its activities and any recommendations.

Review and Changes to the Charter

The GC will review this charter as needed but at least biennially and, following consultation with WECC legal counsel, will recommend any changes to the Board. Modifications to this charter must be approved by the Board.

Approved by the WECC Board of Directors:





Governance Committee Charter

Establishment and Authority

The Governance Committee (GC) is a Board committee established under Section 8.3 of the WECC Bylaws, approved by the Board on June 19, 2018.

Purpose and Responsibilities

The purpose of the GC is to help the WECC Board of Directors (Board) be highly effective and the entire organization to be well-governed.

The committee's primary duties and responsibilities are as follows:

- 1. Oversee implementation and amendment of the Bylaws.
- 2. Periodically review the WECC's Standards of Conduct (Bylaws Appendices A and B) and recommend changes to the Board.
- 3.2. InterfaceCooperate with the Western Interconnection Regional Advisory Body on governance matters.
- 4.3. Interface Cooperate with the Member Advisory Committee on governance matters.
- 5. Annually review the Responsibility and Accountability Matrix to determine if any changesarerequired.
- 6. Manage any documents under its purview consistent with the WECC Document-CategorizationPolicy and update documents for which the committee is responsible.
- 4. Review and update the following documents as needed but at least biennially:
 - Board of Directors Principles of Corporate Governance;
 - Standards of Conduct (for Board Directors and for Officers and Employees); and
 - Responsibility and Accountability Matrix.
- 7.<u>5. En</u>Assure that all Board-<u>approved documents policies</u> and charters are <u>regularly</u> reviewed_ <u>regularly</u> to ensure thattheyand are up to date and relevant. In this task, the GC is assisted by the corporate secretary, who will provide an annual report on the status of these reviews.
- 8.1. Perform such other functions pertinent to governance as may be delegated by the Board.
- 9.6. Discuss education and development opportunities for Board members, including as

Governance Committee Charter

informed by the biennial self-evaluations by Board Committees and the Board of theirrespective bodiesBoard and Board committee self-assessment process.

- <u>10.7.</u> Evaluate biennially in the off years when no evaluation is occurring the thoroughness and effectiveness of the Board <u>and Board committee</u> self-assessment process.
- 8. Make recommendations to assist the Board in making decisions under Bylaws Sections 6.5.2 (removal of Directors) and 6.7.3 (appointment of temporary Directors).
- 9. Perform such other functions pertinent to governance as may be delegated by the Board.

Committee Composition and Governance

1. Membership

- a. The GC will be composed of not fewer than<u>at least</u> three members of the Board, appointed by the chair of the Board in consultation with the Board.
- b. Each member of the GC will serve until a successor is appointed unless the member resigns or is removed by the Board. If a vacancy occurs at any time, the Board chair may fill that vacancy.
- c. No member of the GC may participate as a GC member at any time that the GC may consider any recommendation to the Board that would directly affect the continued service of that Director as a member of the Board of Directors. The Board chair may appoint a temporary, alternate member to serve on the GC in place of any Director who is recused from participation under this paragraph.

2. Leadership

- a. The chair of the Board, in consultation with the Board and with consideration of a Director's interest and expertise, will appoint one GC member to serve as the GC chair. The chair will assign a committee member or a member of the WECC staff to prepare GCmeeting minutes for legal review followed by the committee's approval.
- b. The GC chair will manage the GC and its meetings.
- c. The GC chair may appoint a steering committee to address specific assignments as necessary.

3. Meetings

a. The GC will meet a minimum of twice per year and as often as required to carry out its



Governance Committee Charter

responsibilities. Meetings will be held in accordance with the WECC Meeting Policy and may be in person or by telephone or web conference as determined by the chair.

- b. The GC will determine the procedures for its meetings, except:
 - i. A quorum for meetings is a majority of members of the committee.
 - ii. Action<u>s or Ddecisions</u> taken by the GC require<u>s an affirmative vote of</u> a majority of assigned GC members<u>present</u>.
 - iii. GC members may not vote by proxy or absentee ballot, <u>but GC members may</u> <u>participate in meetings</u>, <u>including casting votes</u>, <u>by telephone conference or any other</u> <u>means of communications that enables all members participating in a meeting to</u> <u>simultaneously hear one anothercommunicate with each other</u>.
- c. The GC chair will provide (or cause to be provided) eEmail notice of the time and place of all meetings will be provided to each member of the GC and to the Board₇ no later than three days before the meeting, or upon as much notice as is reasonable under the circumstances as approved in writing by a majority of GC members. An agenda, including identification of the items for which action may be taken, will be made available at that timeprovided with the meeting notice. Notice of meetings and the agenda will also be posted on the WECC website. Approval item documents should also be posted in advance of the meeting, when possible, but approvals by the GC may differ from what is posted.
- d. The GC chair may call for a closed session of the GC when necessary to protect sensitive or confidential information or to receive attorney client communications for the reasons set forth in sections 7.6.1-1), 2), and 3) of WECC's Bylaws. The GC chair will permit any Director to monitor such closed sessions except those Directors who are conflicted in accordance with sections 7.6.1.1. of the Bylaws or where the GC determines that a Director would have a perceived or actual conflict of interest, to monitor such closed sessions.
- e. The GC chair will provide (or cause to be provided) email notice of the time and place of all closed session meetings to each member of the GC and to the Board, no later than three days before the meeting, or upon as much notice as is reasonable under the circumstances, as approved in writing by a quorum of the committee. This notice willinclude an agenda of the items for which action may be taken.

Reporting

The GC will report to the Board on its activities and any recommendations.



Governance Committee Charter

Review and Changes to the Charter

The GC will review this charter annually<u>as needed but at least biennially</u> and, <u>following consultation</u> <u>with WECC legal counsel</u>, <u>will</u> recommend any changes to the Board following consultation with <u>WECC legal counsel</u>. Modifications to this charter must be approved by the Board.

Approved by the WECC Board of Directors: December 8, 2021.



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WECC Board of Directors

Human Resources and Compensation Committee

Verbal Update

Felicia Marcus, Chair

December 11, 2024



Board of Directors Meeting Approval Item Human Resources and Compensation Committee Charter December 11, 2024

Board Resolution

Resolved, that the WECC Board of Directors (Board), acting on the recommendation of the Human Resources and Compensation Committee (HRCC) at the meeting of the Board on December 11, 2024, approves the HRCC Charter as presented and attached.

Background

A clean and redlined version of the proposed HRCC Charter are included in the Board package. Initial review of the charter was performed by WECC legal with a subsequent review by the HRCC and a recommendation for Board approval expected at the December 10, 2024 HRCC meeting.

Proposed revisions are as follows:

- Minor editorial changes throughout;
- Clarification to CEO selection, input to CEO salary recommendations, and selection and compensation of officers and/or vice presidents;
- Remove language on assigning staff to prepare meeting minutes;
- Clarification on voting requirements and meeting participation;
- Clarification of HRCC submission of ballots;
- Updates to meeting notices, materials posting, and approval requirements for both open and closed sessions; and
- Changing the charter review requirement to "as needed but at least biennially."



Human Resources and Compensation Committee

Charter

Establishment and Authority

The Human Resources and Compensation Committee (HRCC) was established by the WECC Board of Directors (Board).

Purpose and Responsibilities

The purpose of the HRCC is to report to and assist the Board by overseeing the policies, plans, and programs of Human Resources, including employee compensation and benefit plans, officer compensation plans, personnel development, and succession plans for key positions, as well as other matters as directed by the Board or this charter.

To carry out its oversight responsibilities, the HRCC will:

- 1. Review and advise the Board on risks to WECC including:
 - a. Compliance with HR corporate policies;
 - b. Compensation and benefit programs;
 - c. Senior succession planning;
 - d. Workforce diversity, staffing, and retention;
 - e. Training and development;
 - f. Occupational health and safety; and
 - g. Respect in the workplace.
- 2. Oversee and monitor the management and administration of 401(k) and 457(b) plans. This includes oversight of actions and decisions of the CEO and General Counsel, who serve as the Investment Committee and the Plan Administration Committee for the 401(k) and 457(b) plans. The HRCC will report the results of its plan administration oversight and monitoring annually to the Board.
- 3. Recruit and recommend for Board approval, the selection and compensation of a new CEO, as needed.

HRCC Charter

- 4. Annually, at the request of the Board chair, the HRCC may provide input to the Board for consideration when the Board completes its performance assessment and salary adjustment for the CEO.
- 5. Review and recommend for Board approval, after recommendation by and consultation with the CEO, the selection, as needed, and compensation of new corporate officers and/or vice presidents.
- 6. Review and recommend for Board approval:
 - a. Corporate officer/vice president compensation plans, including incentive and at-risk-pay plans;
 - b. Corporate and individual CEO goals;
 - c. Corporate officer/vice president employment agreements, special compensation awards, retention bonus agreements, or severance agreements after consultation with the CEO. (The CEO will inform the HRCC of retention bonus agreements that the CEO has approved for employees below the corporate officer level.); and
 - d. Removal of the CEO, any corporate officer, or any vice president if it serves the best interests of the company.
- 7. The HRCC will have authority and responsibility to appoint, retain, compensate, evaluate and, when appropriate, terminate the business relationship with external legal, compensation, leadership development, or other consultants who—in the opinion of the HRCC—are necessary to assist the HRCC in conducting its business. The HRCC oversees the contract management, qualifications, independence, and performance of external consultants engaged on behalf of the HRCC.
- 8. Perform other duties as requested by the Board.

Committee Composition and Governance

- 1. Membership
 - a. The HRCC will be composed of at least three members of the Board, appointed by the chair of the Board, and in consultation with the Board.
 - b. Each member of the HRCC will serve until a successor is appointed, unless the member resigns or is removed by the Board. If a vacancy occurs at any time, the Board chair may fill the position.
 - c. No member of the HRCC may participate as an HRCC member at any time that the HRCC may consider any recommendation to the Board that would directly affect the continued service of that Director as a member of the Board of Directors. The Board chair may appoint



HRCC Charter

a temporary alternate member to serve on the HRCC in place of any Director who is recused from participation under this paragraph.

2. Leadership

- a. The chair of the Board, in consultation with the Board and with consideration of a Director's interest and expertise, will appoint one HRCC member to serve as the committee chair.
- b. The HRCC chair will manage the HRCC and its meetings.
- c. The HRCC chair may appoint a steering committee to address specific assignments as necessary.

3. Meetings

- a. The HRCC must meet a minimum of twice per year or as often as required to carry out its responsibilities. Meetings will be held according to the WECC <u>Meeting Policy</u> and may be in person or by telephone or web conference as determined by the chair.
- b. The HRCC will determine the procedures for its meetings, except:
 - i. A quorum for meetings is a majority of members of the committee.
 - ii. Actions or decisions taken by the HRCC require an affirmative vote of a majority of HRCC members.
- c. HRCC members may not vote by proxy or absentee ballot, but HRCC members may participate in meetings, including casting votes, by telephone conference or any other means of communication that enables all members participating in a meeting to simultaneously hear one another.
- d. Email notice of the time and place of all meetings will be provided to each member of the HRCC and to the Board, no later than three days before the meeting, or upon as much notice as is reasonable under the circumstances as approved by a majority of HRCC members. An agenda, including identification of the items for which action may be taken, will be provided with the meeting notice. Notice of meetings and the agenda will also be posted on the WECC website. Approval item documents should also be posted in advance of the meeting, when possible, but documents approved by the HRCC may differ from those that are posted.
- e. The HRCC chair may call for a closed session of the HRCC to address any of the items enumerated in subsection f below. The HRCC chair will permit any Director to monitor such closed sessions, except those Directors who are conflicted in accordance with sections 7.6.1.1 of the Bylaws or where the HRCC determines that a Director would have a perceived or actual conflict of interest.



HRCC Charter

- f. The HRCC may meet in closed session to:
 - i. Consider the employment, evaluation of performance, or dismissal of an employee of WECC;
 - ii. Discuss pending or proposed litigation and to receive confidential attorney-client communications from legal counsel; and
 - iii. Receive and discuss any information that is privileged, trade secret, cybersecurity, critical energy infrastructure information (as defined by FERC), protected from public disclosure by law, or that the committee determines should be confidential to protect a legitimate public interest.

Reporting

The HRCC will report at least annually to the Board on its activities and any recommendations.

Review and Changes to the Charter

The HRCC will review this charter biennially and recommend any changes to the Board. Modifications to this charter must be approved by the Board.

Approved by the WECC Board of Directors:





Human Resources and Compensation Committee Charter

Establishment and Authority

The Human Resources and Compensation Committee (HRCC) was established by the WECC Board of Directors (Board).

Purpose and Responsibilities

The purpose of the HRCC is to report to and assist the Board by overseeing the policies, plans, and programs of Human Resources, including employee compensation and benefit plans, officer compensation plans, personnel development, and succession plans for key positions, as well as other matters as directed by the Board or this charter.

To carry out its oversight responsibilities, the HRCC will:

- 1. Review and advise the Board on risks to WECC including:
 - a. Compliance with HR corporate policies;
 - b. Compensation and benefit programs;
 - c. Senior succession planning;
 - d. Workforce diversity, staffing, and retention;
 - e. Training and development;
 - f. Occupational health and safety; and
 - g. Respect in the workplace.
- 2. Oversee and monitor the management and administration of 401(k) and 457(b) plans. This includes oversight of actions and decisions of the CEO and General Counsel, who serve as the Investment Committee and the Plan Administration Committee for the 401(k) and 457(b) plans. The HRCC will report the results of its plan administration oversight and monitoring annually to the Board.
- 3. Recruit and recommend for Board approval, the selection and compensation of a new CEO<u>, as</u> <u>needed</u>.

HRCC Charter

- 4. Annually, at the request of the Board chair, the HRCC may provide input to the Board for consideration when the Board completes its performance assessment and salary adjustment for the CEO...
- Review and recommend for Board approval, after consultation-recommendation by and consultation with with the CEO, the selection, as needed, and compensation of new corporate officers and/or vice presidents, then conduct annual compensation reviews of current corporate officers.
- 6. Review and recommend for Board approval:
 - a. <u>Executive-Corporate officer/vice president</u> compensation plans, including incentive and atrisk-pay plans;
 - b. Corporate and individual CEO goals;
 - c. Corporate <u>officer officer/vice president</u> employment agreements, special compensation awards, retention bonus agreements, or severance agreements after consultation with the CEO. (The CEO will inform the HRCC of retention bonus agreements that the CEO has approved for employees below the corporate officer level.); and
 - d. Removal of the CEO, any corporate officer, or any vice president if it serves the best interests of the company.
- 7. The HRCC will have the sole-authority and responsibility to appoint, retain, compensate, evaluate and, when appropriate, terminate the business relationship with external legal, compensation, leadership development, or other consultants who—in the opinion of the HRCC—are necessary to assist the HRCC in conducting its business. The HRCC oversees the contract management, qualifications, independence, and performance of external consultants engaged on behalf of the HRCC.
- 7.8. Perform other duties as requested by the Board.

Committee Composition and Governance

- 1. Membership
 - a. The HRCC will be composed of not fewer than<u>at least</u> three members of the Board, appointed by the chair of the Board, and in consultation with the Board.
 - b. Each member of the HRCC will serve until a successor is appointed, unless the member resigns or is removed by the Board. If a vacancy occurs at any time, the Board chair may fill the position.
 - c. No member of the HRCC may participate as an HRCC member at any time that the HRCC may consider any recommendation to the Board that would directly affect the continued



HRCC Charter

service of that Director as a member of the Board of Directors. The Board chair may appoint a temporary alternate member to serve on the HRCC in place of any Director who is recused from participation under this paragraph.

- 2. Leadership
 - a. The chair of the Board, in consultation with the Board and with consideration of a Director's interest and expertise, will appoint one HRCC member to serve as the committee chair. The chair will assign a committee member or a member of the WECC staff to prepare HRCC meeting minutes for legal review followed by the committee's approval.
 - b. The HRCC chair will manage the HRCC and its meetings.
 - c. The HRCC chair may appoint a steering committee to address specific assignments as necessary.

3. Meetings

- a. The HRCC must meet a minimum of twice per year or as often as required to carry out its responsibilities. Meetings will be held according to the WECC <u>Meeting Policy</u> and may be in person or by telephone or web conference as determined by the chair.
- b. The HRCC will determine the procedures for its meetings, except:
 - i. A quorum for meetings is a majority of members of the committee.
 - Actions or decisions taken by the HRCC requires an affirmative vote of a majority of assigned-HRCC members.
- 4-c. HRCC members may not vote by proxy or absentee ballot, but HRCC members may participate in meetings, including casting votes, by telephone conference or any other means of communications that enables all members participating in a meeting to simultaneously hear one another.-
- a.d. The HRCC chair will provide (or cause to be provided) eEmail notice of the time and place of all meetings will be provided to each member of the HRCC and to the Board, no later than three days before the meeting, or upon as much notice as is reasonable under the circumstances as approved by a majority of HRCC members. An agenda, including identification of the items for which action may be taken, will be made available at that timeprovided with the meeting notice. Notice of meetings and the agenda will also be posted on the WECC website. Approval item documents should also be posted in advance of the meeting, when possible, but documents approvalsed by the HRCC may differ from whatthose that are is posted.



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HRCC Charter

- **b-c.** The HRCC chair may call for a closed session of the HRCC <u>to address any of the items</u> <u>enumerated in subsection f below, when necessary to protect sensitive or confidential</u> information or to receive attorney client communications. The HRCC chair will permit any Director <u>to monitor such closed sessions</u>, except those Directors who are conflicted in accordance with sections 7.6.1.1 of the Bylaws or where the HRCC determines that a Director would have a perceived or actual conflict of interest, to monitor such closed sessions.
- erf. The HRCC chair will provide (or cause to be provided) email notice of the time and place of all closed session meetings to each member of the HRCC and to the Board, no later than three days before the meeting or upon as much notice as is reasonable under the circumstances, as approved in writing by a quorum of the committee. This notice will include an agenda of the items for which action may be taken.
- d.g. The HRCC may meet in closed session to:
 - Consider the employment, evaluation of performance, or dismissal of an employee of WECC;
 - ii. Discuss pending or proposed litigation and to receive confidential attorney-client communications from legal counsel; and
 - iii. Receive and discuss any information that is privileged, trade secret, cybersecurity, critical energy infrastructure information (as defined by FERC), protected from public disclosure by law, or that the committee determines should be confidential to protect a legitimate public interest.

Reporting

The HRCC will report at least annually to the Board on its activities and any recommendations.

Review and Changes to the Charter

The HRCC will review this charter <u>annually <u>biannually</u>biennially</u> and recommend any changes to the Board. <u>Modifications to this charter must be approved by the Board.</u>

Approved by the WECC Board of Directors: September 08, 2021



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Board of Directors Meeting Approval Item Re-appointment of Corporate Officers December 11, 2024

Board Resolution

Resolved, that the WECC Board of Directors (Board), acting on the recommendation of the Human Resources and Compensation Committee (HRCC) at the meeting of the Board on December 11, 2024, approves the re-appointment of the following officers of the corporation, as presented and indicated as follows:

- Melanie Frye, President and Chief Executive Officer
- Jillian Lessner, Vice President, Chief Financial & Administrative Officer
- Branden Sudduth, Vice President, Reliability Planning & Performance Analysis
- Jeff Droubay, Vice President, General Counsel and Corporate Secretary
- Kris Raper, Vice President, Strategic Engagement and External Affairs
- Steve Noess, Vice President, Reliability & Security Oversight

Background

In 2016, the Board adopted the practice, like that of NERC, of annually re-appointing the officers of the corporation. The listed individuals will remain appointed officers of the corporation until further action is taken by the Board or the individuals are no longer employed by WECC. The proposed reappointments demonstrate the Board's intent and ensure that the matter of officer appointments remains an issue of regular Board attention.



Board of Directors Approval Item 2025 Corporate Scorecard December 11, 2024

Board Resolution

Resolved, that the WECC Board of Directors (Board), acting upon the recommendation of the Human Resources and Compensation Committee (HRCC), at the meeting of the Board on December 11, 2024, approves the 2025 Corporate Scorecard, as presented and attached.

Background

WECC's 2025 Corporate Scorecard sets annual corporate goals in five impact areas with corresponding metrics, targets, and initiatives. The scorecard aligns business performance with the achievement of WECC's mission, vision, and strategy. Board approval of the Corporate Scorecard demonstrates corporate governance and Board oversight.

Issues and Risks

Board approval of the Corporate Scorecard demonstrates Board oversight of organizational performance. The Scorecard provides the Board with visibility into WECC's achievement of its delegated responsibilities, sound business practices, impact on industry, effective and efficient processes, and successes in the organization through quarterly and annual reporting.



DRAFT 2025 Corporate Scorecard December 2024

Impact Area 1

Risk Mitigation: We are an organization aligned around risk reduction. Our holistic risk-based approach uses all the tools and skills available to deliver comprehensive risk mitigation strategies.

Metrics	Targets	Initiatives
1. Number of Reliability Risk Priorities (RRP)s that have a set of	1. 1	1. Move toward our vision of a holistic risk-based approach by piloting a multi-year integrated oversight and risk mitigation
comprehensive/holistic mitigation strategies.		strategy for Inverter Based Resources (IBR). This strategy will be a model for other RRPs and the comprehensive, holistic
2. % reduction in violation inventory that is over two years old as of	2. 25%	strategies developed for them.
1/1/25.		2. Enhance WECC's capability to receive and incorporate technical advice from stakeholders in support of our holistic risk
3. % of newly registered IBR entities that WECC has, within 90 days	3. 90%	management process by targeted engagement with identified stakeholder groups.
of registration, conducted outreach discussion with the entity's		3. Improve resource adequacy assessments (RA) by expanding energy assessment capabilities and using results from transfer
primary compliance contact and, as applicable, initiated a Self-		capability analysis to better model transmission constraints.
Certification of the entity to confirm its reliability and security		4. Implement a collaborative extreme weather preparedness assurance program to facilitate best practices sharing and
foundation supports its compliance obligations.		assessment of interconnection-wide readiness.
4. % of completed mitigation and treatment strategies to address	4. 100%	
RRPs (identified for the given year).		

Impact Area 2

Partnership: We are sought after as a partner to address the most challenging reliability issues. We identify concerns and facilitate solutions with input from diverse and often conflicting stakeholder perspectives, focusing our resources on risks that pose the greatest threat to reliability and security.

	Metrics	Targets		Initiatives
1.	% increase in new products initiated in collaboration with stakeholders	1. 10%	1.	Implement a strategy for increasing engagement and responsiveness directly with WECC Member Representatives that specifically identifies the value to both WECC and WECC Members from such increased engagement.
2.	% reduction of the priority power flow model shortcomings identified in the previous year's operating cases versus the current year's operating cases.	2. 20%	2.	Increase the focus on risk mitigation across the Interconnection by implementing a single risk treatment strategy tracker that tracks, updates, and informs staff and stakeholders of prioritized treatment strategies that address known and emerging reliability and security risks within the Western Interconnection.
3.	# of requests to participate about Western Interconnection reliability in collaborative groups/forums.	3. 8		

Draft 2025 Corporate Scorecard

Impact Area 3

Perspective: Our insights, analyses, and outreach promote industry action. We are renowned for providing clear and actionable communications supported by data and rigorous analysis.

	Metrics	Targets		Initiatives
1.	# of WECC recommendations for industry action that are specific,	1. 3	1.	To further drive the rigor and quality of our analytical work, optimize our current industry-standard data management
	targeted, and tracked.			platform to create organization-wide governance around data management. This initiative will align with the ERO Enterprise
2.	% of applicable stakeholders that have taken action to address	2. 50%		Analytics strategy.
	WECC recommendations.		2.	Increase the impact of the recommendations contained in our technical work by ensuring the recommendations are actionable
3.	# of WECC products/trainings/outreach efforts that are newly	3. 7		by industry and then following up with industry to verify progress on those recommendations. This initiative will include a
	created or enhanced/improved to align to WECC's stakeholder			recommendation vetting and tracking tool.
	outreach strategy and RRPs.		3.	Elevate our outreach by developing a holistic social media strategy including, but not limited to targeted messaging through
4.	# of WECC multimedia products developed and posted regarding	4. 5		video presentations embedded in our products and posted separately to social media.
	WECC's products to increase their reach and impact.			

Impact Area 4

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Independence: Our resource and technology neutral, interconnection-wide perspective is respected and trusted to provide confidence to decision-makers that they have an independent partner to rely on.

	Metrics	Targets		Initiatives
1.	# of external citations of or references to our technical work in identified publications or forums.	1. 12	1.	Implement an appropriate stakeholder relationship management tool to track engagement partners and activities that can assist in WECC's Mission.
2.	# of requests to participate in or collaborate with targeted industry groups focused on reliability initiatives and topics	2. 6	2.	Develop metrics using data from the relationship management tool that enable us to measure our impact and respond quickly to the needs of stakeholders with the ability to mitigate key risks to reliability in the West. These metrics will include the
3.	# of products that target a specific/identified group of decision- makers to educate them on one or more of our identified RRPs.	3. 5		tracking of citations, speaking engagements, collaborative partnerships, executive outreach, and outreach to identified stakeholders etc.
			3.	Increase our impact and credibility with decision-makers by creating a series of Bulk Power Grid Reliability basics video presentations with non-technical decision-makers, legislators, etc. as the target audience.

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Draft 2025 Corporate Scorecard

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Impact Area 5

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People: Our highly skilled and engaged employees are champions for reliability.

Metrics	Targets	Initiatives
1. Voluntary employee turnover	1. <15%	1. Further enhance employee engagement by:
2. % of critical skills covered by staff expertise	2. 75%	a. Assembling a cross-functional team to develop and implement plans to improve two Denison indices, including
3. # of processes improved	3. 10	milestones and monitoring.
4. % of statutory budgeted expenditures	4. +/-3%	 Develop and roll out a stay interview process to collect data related to employee engagement and departure risks which includes action plans for addressing data gathered during the interviews.
		 Build upon current college recruitment strategy by developing an internship program to create a pipeline of candidates, introduce students to WECC, and augment existing staff skillsets.

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WECC Board of Directors Nominating Committee

Verbal Update

Ian McKay, Chair

December 11, 2024
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WECC Standards Committee (WSC) Report to the WECC Board of Directors

Joe McArthur, WSC Chair

Steve Rueckert, Director of Standards

December 11, 2024

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WSC Report to the Board-December 11, 2024

Highlights

Project WECC-0142 BAL-002-WECC-3 Contingency Reserve Regional Reliability Standard retirement posted for comment—page 3.

Revised WSC Charter – page 3.

Standard Authorization Request submitted to revised WECC Regional Variance in NERC Reliability Standard VAR-001-5—page 3.

Strategic Purpose

The purpose of the WECC Standards Committee (WSC) is to oversee the implementation of the WECC Reliability Standards Development Procedures (Procedures).

The WSC will-

- 1. Maintain and administer the Procedures, including:
 - a. Due process,
 - b. Balloting,
 - c. Annual review of the WECC Glossary of Terms and Naming Conventions, and
 - d. Meeting the quality control attributes of FERC Order 672.
- 2. Administer each Standard Authorization Request (SAR) to ensure the project:
 - a. Is within WECC's authority to develop,
 - Is appropriate for development by WECC, and
 - b. Remains within the scope of the SAR, as may be changed by the WSC.
- 3. Monitor and manage drafting teams, including:
 - a. Team selection, and
 - b. Provision of general oversight and guidance to include a description and explanation of the project to be drafted and time prioritization where needed.
- 4. Monitor and manage the development of projects created per the Procedures, including prioritization.
- 5. Perform other duties assigned by the Board of Directors (Board).

WECC Board Action Items

The WSC requests Board approval of proposed revisions to the WSC Charter at the December meeting. Revisions include minor changes proposed by the WSC and conforming changes proposed by the WECC General Counsel.

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WSC Report to the Board—December 11, 2024

Current Year Goals

- Keep the WECC Standards Development Process moving forward by overseeing the drafting teams.
- Act on requests and recommendations from the drafting teams.
- Review the WSC Charter and WECC Procedures to revise and improve them.

Major Accomplishments and Planned Activities

1. Project WECC-0142-BAL-002-WECC-3 Contingency Reserve Regional Reliability Standard Request to Retire.

The Standard Authorization Request (SAR) proposing retirement of this WECC Regional Reliability Standard was initially received on August 14, 2020. A drafting team was appointed, and the development of justification for retirement began. The project was put in abeyance during the COVID pandemic. The effort to justify retirement began again early this year, and the team met regularly. The team has completed its proposed justification for retirement and posted the proposed draft for comment beginning November 15, 2024, and closing January 15, 2025.

2. Drafting Team for WECC-0155—WECC Underfrequency Load Shedding Criterion Five-year Review

The WSC approved drafting team members for the required five-year review of this WECC Criterion.



Board of Directors Meeting Approval Item WECC Standards Committee Charter December 11, 2024

Board Resolution

Resolved, that the WECC Board of Directors (Board), acting on the recommendation of the WECC Standards Committee (WSC) at the meeting of the Board on December 11, 2024, approves the WSC Charter as presented and attached.

Background

A clean and redlined version of the proposed WSC Charter are included in the Board package. Initial review of the charter was performed by WECC legal with a subsequent review by the WSC and a recommendation for Board approval at the November 25, 2024, WSC meeting.

Proposed revisions are as follows:

- Minor editorial changes throughout;
- Clarification of balloting requirements and meeting participation;
- Updates to meeting notices, materials posting, and approval requirements for both open and closed sessions;
- Clarification on process to approve an action without a meeting; and
- Changing the charter review requirement to "as needed but at least biennially."

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WECC Standards Committee Charter

Establishment and Authority

The WECC Standards Committee (WSC) is established by the WECC Board of Directors under Section 8.3 of the WECC Bylaws.

Purpose and Responsibilities

The purpose of the WSC is to oversee the implementation of the WECC Reliability Standards Development Procedures (Procedures) pursuant to this Board-approved charter.¹

The WSC will-

- 1. Maintain and administer the Procedures, including:
 - a. Due process,
 - b. Balloting,
 - c. Annual review of the WECC Glossary of Terms Used in WECC Criteria, and
 - d. Meeting the quality control attributes of FERC Order 672.
- 2. Administer each Standard Authorization Request (SAR) to ensure the requested project:
 - a. Is within WECC's authority to develop;
 - b. Is appropriate for development by WECC; and
 - c. Remains within the scope of the SAR, as may be changed by the WSC.
- 3. Monitor and manage the development of projects created per the Procedures including:
 - a. Drafting team selection,
 - b. Provision of general oversight and guidance to include a description and explanation of the project to be drafted, and
 - c. Time and resource prioritization where needed.
- 4. Perform other duties assigned by the Board.

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¹ The Procedures require approval by the Board, NERC, and FERC.

WSC Charter

Committee Composition and Governance

1. Membership

- a. The WSC will be composed of one representative from each of the WECC Standards Voting Segments (SVS) as defined in the Procedures, plus one member of the Board assigned by the Board chair to serve as the WSC chair.
- b. Eligibility
 - i. An individual is eligible to serve on the WSC if that individual:
 - Meets the membership eligibility criteria in the Segment Qualifications Guidelines and Segment definitions in the NERC Rules of Procedure, Appendix 3D, registered Ballot Body Criteria, as amended from time to time, and
 - 2) Agrees to place reliability of the Western Interconnection ahead of personal or corporate interests.
 - ii. No individual, firm, or affiliate will serve in more than one SVS at a time.
 - iii. Questions regarding eligibility, affiliation, or balloting will be decided by the WSC in consultation with WECC legal.
- c. Balloting
 - i. A request for WSC SVS nominations must be announced and remain open for no less than 14 days. Self-nominations are permitted.
 - ii. At the close of the nomination period, notice of ballot will be dispatched announcing the ballot window and providing balloting instructions. The ballot window will remain open for:
 - 1) No less than 14 days or until the sum of the ballots cast becomes outcome determinant, and
 - 2) No more than 30 days.
 - iii. To be eligible to vote, an individual:
 - 1) Must be registered in the WECC Ballot Body;
 - 2) May cast a vote in all SVSs in which the individual is registered; and
 - 3) Only one vote may be cast per entity per SVS.
 - iv. The nominee with the most votes in an SVS is elected as the representative for that SVS.If there is only one nominee for an SVS, balloting is waived, and the nominee is deemed elected.



WSC Charter

- v. In the event of a tie ballot, the WSC chair will cast the deciding vote.
- vi. The names of elected representatives will be given to the Board for informational purposes.
- d. Terms of Service
 - i. Normal Term of Service
 - 1) Will be two years;
 - 2) Will be staggered so only half the terms expire coincidentally; and
 - 3) Will begin and end at the closing of the WECC Annual meeting.
 - ii. Interim Term of Service
 - 1) The WSC chair may decide not to fill an interim vacancy, in which case the vacancy would be filled during the next normal term of service.
 - iii. Removal
 - The WECC Board may remove a WSC member upon a joint finding by the WSC chair and the Board chair that the member's conduct on the WSC is inconsistent with membership eligibility.

2. Leadership

- a. The Board chair will assign a Board member to serve as the WSC chair.
- b. The WSC chair will manage the committee and its meetings.
- c. The WSC will elect a vice chair to perform the duties of the chair in the chair's absence or in case of a vacancy in the office of chair.

3. Meetings

- a. The WSC will determine the procedures for its meetings.
- b. A quorum for meetings will be a majority of the WSC's current membership. A meeting quorum is determined by a count of those present in-person and present by other real-time interactive communication media. If an SVS position is vacant, the number needed to establish a quorum is reduced accordingly.
- c. Action taken by the WSC requires a majority vote of those WSC members in attendance.
- d. WSC meetings may be in person, by conference call, by video conference, or any other means of communication that enables all members participating in a meeting to simultaneously communicate with each other, including casting votes, as determined by the chair.



WSC Charter

- e. Email notice of the time and place of all meetings will be provided to each member of the WSC and to the Board no later than three days before the meeting, or upon as much notice as is reasonable under the circumstances as approved by a majority of WSC members. An agenda, including identification of the items for which action may be taken, will be provided with the meeting notice. Notice of meetings and the agenda will also be posted on the WECC website. Approval item documents should also be posted in advance of the meeting, when possible, but documents approved by the WSC may differ from what is posted.
- f. Persons seeking notice of WSC meetings will be added to the email list established and maintained by WECC for communicating standards related due process activity (Email List).
- 4. All meetings of the WSC under this section are open to the public, except that the chair of the WSC may call for a closed session—according to the Board Closed and Western Interconnection Data Sharing Agreement (WIDSA) Sessions Policy—to discuss confidential or non-public information, to receive attorney-client communications, or to discuss pending or anticipated litigation.
- 5. Actions without a Meeting
 - a. The WSC may act by ballot without holding a meeting.
 - b. A ballot to approve an action without a meeting (AWM) may be taken by any method the chair deems appropriate, after consultation with WECC's General Counsel.
 - c. An AWM requires an affirmative vote of a majority of the members of the WSC.
 - d. An AWM may be initiated at the request of the chair or any three SVS representatives.
 - e. WECC will distribute notice of the proposed AWM to the Email List and the WSC members, stating the nature of the business to be undertaken.
 - f. Notice of the AWM will be given no less than three days in advance of the requested action.
 - g. Results of the AWM will be distributed to the WSC members no less than five days after the close of the AWM.
 - h. A report of all AWMs will be made at the next regularly scheduled WSC meeting.

Proxies

Each WSC member is authorized to designate a proxy for purposes of quorum and action items to be addressed by the WSC.

To assign a proxy, the assigning WSC member must notify the WECC WSC Liaison and provide:



WSC Charter

- 1. The reason for the request,
- 2. The name of the proxy representative, and
- 3. The SVS represented.

The proxy will adhere to the voting member's expectations and responsibilities as described in this charter.

A WSC member cannot serve as a proxy for another WSC member.

Reporting

The WSC will report to the Board on its activities and any recommendations.

The WSC will annually review each subcommittee, task force, or work group that reports to the WSC to determine whether that group is still necessary or should be dissolved.

Review and Changes to the Charter

The WSC will review this charter as needed but at least biennially and recommend any changes to the Board for approval.

Approved by the WSC: November 25, 2024

Approved by the WECC Board of Directors: Targeted for December 2024





WECC Standards Committee Charter

Establishment and Authority

The WECC Standards Committee (WSC) is established by the WECC Board of Directors under Section 8.3 of the WECC Bylaws.

Purpose and Responsibilities

The purpose of the WSC is to oversee the implementation of the WECC Reliability Standards Development Procedures (Procedures) pursuant to this Board-approved charter.¹

The WSC will-

- 1. Maintain and administer the Procedures, including:
 - a. Due process,
 - b. Balloting,
 - c. Annual review of the WECC Glossary of Terms Used in WECC Criteria, and
 - d. Meeting the quality control attributes of FERC Order 672.
- 2. Administer each Standard Authorization Request (SAR) to ensure the requested project:
 - a. Is within WECC's authority to develop;
 - b. Is appropriate for development by WECC; and that it
 - c. Remains within the scope of the SAR, as may be changed by the WSC.
- 3. Monitor and manage the development of projects created per the Procedures including:
 - a. Drafting team selection,
 - b. Provision of general oversight and guidance to include a description and explanation of the project to be drafted, and
 - c. Time and resource prioritization where needed.
- 4. Perform other duties assigned by the Board.

¹ The Procedures require approval by the Board, NERC, and FERC.

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WSC Charter

Committee Composition and Governance

1. Membership

- a. The WSC will be composed of one representative from each of the WECC Standards Voting Segments (SVS) as defined in the Procedures, plus one member of the Board assigned by the Board chair to serve as the WSC chair.
- b. Eligibility
 - i. An individual is eligible to serve on the WSC if that individual:
 - Meets the membership eligibility criteria in the Segment Qualifications Guidelines and Segment definitions in the NERC Rules of Procedure, Appendix 3D, registered Ballot Body Criteria, as amended from time to time, and
 - 2) Agrees to place reliability of the Western Interconnection ahead of personal or corporate interests.
 - <u>ii.</u> No individual, firm, or affiliate will serve in more than one SVS at a time. The Director of Standards has authority to make the final determination on the question of affiliation.

ii.iii. Questions regarding eligibility, affiliation, or balloting will be decided by the WSC in consultation with WECC legal.

- c. Balloting
 - i. A request for WSC SVS nominations must be announced and remain open for no less than 14 days. Self-nominations are permitted. Each nominee's eligibility will be verified under the direction of the Director of Standards.
 - ii. At the clos<u>eing</u> of the nomination period, notice of ballot will be dispatched announcing the ballot window and providing balloting instructions. The ballot window will remain open for:
 - 1) No less than 14 days or until the sum of the ballots cast becomes outcome determinant, and
 - 2) No more than 30 days.
 - iii. To be eligible to vote, an individual:
 - 1) Must be registered in the WECC Ballot Body, and;
 - 2) May cast a vote in all SVSs in which the individual is registered.; and
 - 3) Only one vote may be cast per entity per SVS.



WSC Charter

- iv. The nominee with the most votes in an SVS is elected as the representative for that SVS.If there is only one nominee for an SVS, balloting is waived, and the nominee is deemed elected.
- v. In the event of a tie ballot, the WSC chair will cast the deciding vote.
- vi. The names of elected representatives will be given to the Board for informational purposes.
- d. Terms of Service
 - i. Normal Term of Service
 - 1) Will be two years-;
 - 2) Will be staggered so only half the terms expire coincidentally.; and
 - 3) Will begin and end at the closing of the WECC Annual meeting.
 - ii. Interim Term of Service
 - 1) The WSC chair may decide not to fill an interim vacancy, in which case the vacancy would be filled during the next normal term of service.
 - iii. Removal
 - The WECC Board may remove a WSC member upon a joint finding by the WSC chair and the Board chair that the member's conduct on the WSC is inconsistent with membership eligibility.

2. Leadership

- a. The Board chair will assign a Board member to serve as the WSC chair.
- b. The WSC chair will manage the committee and its meetings.
- c. The WSC will elect a vice chair to perform the duties of the chair in the chair's absence or in case of a vacancy in the office of chair.
- . WECC Standards staff will serve as the steering committee assisting with meeting agendas and action recommendations.

4.3. Meetings

- a. The WSC will determine the procedures for its meetings.
- b. A quorum for meetings will be a majority of the WSC's current membership. A meeting quorum is determined by a count of those present in-person and present by other real-time interactive communication media. Once a quorum is established it remains in place until the



WSC Charter

meeting is adjourned. If an SVS position is vacant, the number needed to establish a quorum is reduced accordingly.

- c. Action taken by the WSC requires a majority vote of those <u>WSC</u> members <u>presentin</u> <u>attendance</u>.
- d. WSC meetings may be in person, or by conference call, by video conference, or any other means of communication that enables all members participating in a meeting to simultaneously communicate with each other, including casting votes, as determined by the chair.
- e. The chair (or designee) will cause notice to be given of the time and place of all meetings and will cause notice of all meetings to be posted on the WECC website. Notice shall be given no less than three days before each meeting. Email notice of the time and place of all meetings will be provided to each member of the WSC and to the Board no later than three days before the meeting, or upon as much notice as is reasonable under the circumstances as approved by a majority of WSC members. An agenda, including identification of the items for which action may be taken, will be provided with the meeting notice. Notice of meetings and the agenda will also be posted on the WECC website. Approval item documents should also be posted in advance of the meeting, when possible, but documents approved by the <u>FACWSC</u> may differ from what is posted.

e.

- f. An agenda, including the items for which action may be taken, will be posted to the associated calendar event.
- g.f. Persons seeking notice of WSC meetings will be added to the Ee mail list established and maintained by WECC for communicating standards related due process activity (Email List). Any person who wants notice of WSC meetings may notify the WECC Standards staff or WECC administrative support.
- 5.4. All meetings of the WSC under this section are open to the public, except that the chair of the WSC may call for a closed session—according to the Board Policy on Closed and Western Interconnection Data Sharing Agreement (WIDSA) Sessions for Member GroupsPolicy—to discuss confidential or non-public information, to receive attorney-client communications, or to discuss pending or anticipated litigation.

6.5. Actions without a Meeting

a. The WSC may act by ballot without holding a meeting-as described above in Section 3 Meetings.



- b. A ballot to approve an action without a meeting (AWM) may be taken by any method the chair deems appropriate, after consultation with WECC's General Counsel.
- c. A quorum is required, except that the WSC member need not be present in person or present by real-time interactive communication media.<u>An action taken without a</u> <u>meeting</u>AWM requires an affirmative votwe of a majority of the members of the WSC.
- d. An action without a meeting<u>AWM</u> may be <u>convened-initiated</u> at the request of the chair or any three SVS representatives.
- e. WECC will distribute notice of the proposed AWM to the Standard-Email List and the WSC members, stating the nature of the business to be undertaken.
- f. Notice of the AWM will be given no less than three days in advance of the requested action.
- g. Results of the AWM will be distributed to the WSC members no less than five days after the close of the AWM.
- h. A report of all actions taken without a meeting AWMs will be made at the next regularly scheduled WSC meeting.

Proxies

Each WSC member is authorized to designate a proxy for purposes of quorum and action items to be addressed by the WSC.

To assign a proxy, the assigning WSC member must notify <u>the WECC WSC Liaison Standards staff</u> and provide:

- 1. The reason for the request,
- 2. The name of the proxy representative, and
- 3. The SVS represented.

The proxy will adhere to the voting member's expectations and responsibilities as described in this charter.

A WSC member cannot serve as a proxy for another WSC member.

Reporting

The WSC will report to the Board on its activities and any recommendations.

The WSC will annually review each subcommittee, task force, or work group that reports to the WSC to determine whether that group is still necessary or should be dissolved.



WSC Charter

Review and Changes to the Charter

The WSC will annually-review this charter <u>as needed but at least biennially</u> and recommend any changes to the Board <u>for approveal</u>.

Approved by the WSC: December 6, 2023November 25, 2024

Approved by the WECC Board of Directors: Targeted for December 2024



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WECC Standards Committee

December 11, 2024

Joe McArthur WSC Chair



Approval Item

- WSC Charter
 - Proposed clarifying changes by WECC General Counsel for consistency between WECC Board Committees.
 - Removed statement that once a quorum is established, it remains in place.
 - Changed annual review of the charter to biennial review.

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WSC Meeting

- The WSC held a virtual meeting on November 25.
 - Approved Charter Revisions.
 - Accepted a Standards Authorization Request (SAR) for revisions to the WECC Regional Variance in the NERC Reliability Standard VAR-001-5 Voltage and Reactive Control.
 - Necessary due to NERC's recent changes to Generator registration criteria.
 - WECC Variance refers to Generators connected to the Bulk Electric System.

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Technical Activities Update to the WECC Board of Directors

Branden Sudduth, VP of Reliability Planning and Performance Analysis Kris Raper, VP of Strategic Engagement and External Affairs Philip Augustin and Chelsea Loomis, RAC Co-chairs Dede Subakti and Margaret Albright, RRC Co-chairs

December 11, 2024

Technical Activities Report to the Board—December 11, 2024

This report is a compilation of activities being undertaken by the Reliability Planning and Performance Analysis department, the Strategic Engagement and External Affairs department, and the WECC technical committees.

New Initiatives and Recent Activity Highlights

Interregional Transfer Capability Study (ITCS)

NERC delivered the ITCS to FERC on November 18, ahead of the December 2, 2024, deadline. The completed ITCS includes four separate reports: Overview of Study Needs and Approach, Transfer Capability Analysis (Part 1), Prudent Additions (Part 2) and Recommendations (Part 3), and Canadian Analysis.

The initial report, the Overview of Study Need and Approach, was released in June and provides a foundational context on the study details and explains the need for this crucial project. The Transfer Capability Analysis (Part 1 report) determined the current transfer capability across the United States and was released in August. The report containing Parts 2 and 3 was published in early November and identifies "prudent additions" to transfer capability between neighboring areas and the recommendations to meet and maintain transfer capability. These three reports are posted on NERC's ITCS <u>webpage</u> and are supplemented with maps and infographic summaries.

The fourth report for Canadian Analysis will identify and make recommendations to transfer capability from the United States to Canada or between Canadian provinces and is expected to be published in Q1 of 2025. This analysis will be a supplement to the other three ITCS reports and was not required to meet the December 2, 2024, ITCS deadline.

Western Interconnection Wildfire Update

Wildfire continues to pose a threat to the BES in 2024. The number of wildfires remained nearly flat when compared to the five-year average, however size and location are the key factors when determining impact on the BES. On many occasions, wildfires forced the interconnection to operate in a potential open loop condition, meaning the interconnection was one contingency away from separating into islands and interrupting major transfer paths. Throughout the season, there were several key transmission lines lost due to wildfires, which resulted in Path de-rates that affected energy transfers. At several times, Path 66, the California-Oregon Intertie (COI), was reduced to 0 MW north to south and south to north. Path 65, the Pacific DC Intertie, also experienced several de-rates due to wildfires, reducing energy transfers. These de-rates subsequently forced higher flows on the eastern side of the interconnection causing congestion on this weaker part of the system.

Wildfires affected several inverter-based resources (IBR) in June when two 500-kV lines tripped due to nearby wildfires. The plants tripped offline inadvertently, dropping 934 MW of generation. In October, the Pine Fire caused a Remedial Action Scheme to trigger due to loss of transmission, dropping over



Technical Activities Report to the Board-December 11, 2024

2,000 MW of generation. Loss of solar generation due to smoke cover is an growing issue as solar generation continues to increase. The exact loss is difficult to measure but is observable through low system frequency events and changes in power flows across the Bulk Power System. Active wildfires (10 acres or larger) peaked in July and August with 800 fires identified and numbers decreasing gradually in September and October, during which time 300 incidents were identified throughout the Western Interconnection.

WECC Situation Awareness staff provided information on wildfire impacts to the BES in the WECC Weekly Update email. These updates also included information and trends on how the current week's wildfire activity compared with previous weeks and the forecast for the upcoming week. These weekly updates and information have been well received and valued by stakeholders across the Western Interconnection.

WECC staff continues to monitor wildfire activity and the impacts to the reliable operation of the Bulk Power System through its annual Wildfire Data Request. Responses to this request include information collected and analyzed from entities in the United States, British Columbia, and Alberta on how wildfires affected the operation of BES transmission lines. This request will be issued to applicable Transmission Operators in early January 2025 and cover the period from January 1, 2024, through December 31, 2024.

Reliability in the West Discussion Series

In February, WECC began hosting a "Reliability in the West" Discussion Series. We have included many different stakeholders in several conversations about matters most critical to the reliability of the grid. In October, the discussion focused on large loads and included representatives from Amazon, the Department of Energy, and the Maryland PUC. November's discussion explored ongoing resource challenges and current resource planning practices, with a discussion of the role of resource adequacy programs like the Western Resource Adequacy Program (WRAP). The discussion included representatives from Western Power Pool, Idaho Power, and Salt River Project. In December and January, the series will take its new year break and return in February.

Cold Weather Efforts

WECC has put together a cross departmental team to gain additional insights on the cold weather generator readiness risk within the interconnection. This team is addressing several recommendations that FERC tasked NERC and the regions with in the <u>Winter Storm Elliot Report</u>. WECC completed recommendation 1b in May, which is to perform an evaluation of the cold weather readiness of the generation fleet that poses the highest risk to the BES. This same team is working on a similar effort for recommendation 1c, which is to perform a risk-based generator readiness assessment. This effort is well under way with responses back from the selected entities and either follow-up calls or site visits scheduled. This effort will conclude in Q1 of 2025.



Technical Activities Report to the Board-December 11, 2024

Recommendation 3 of the report asks NERC and the regions to perform a readiness review of the Black Start Generation Fleet across North America. Responses to Requests for Information have been received and are being reviewed. The team is also working with gas suppliers to account for fuel supply challenges during extreme cold conditions. This effort will be documented in an industry report that is scheduled to be completed in Q1 of 2025.

System Performance Data and Metrics

Event Analysis (EA)/Situation Awareness (SA)

The Operations Analysis team at WECC maintains situation awareness through various means. One source of system events is mandatory reporting through the Department of Energy's OE-417 and the NERC Reliability Standard's EOP-004-4 process. Most of the reports received throughout 2024 have dealt with substation break-ins for copper or equipment theft.

One of the risk priorities for WECC has been the impact of IBRs. The Event Analysis team has investigated five category 1i events in 2024, which are events that include any nonconsequential inverter-based resource loss of over 500 MW. This is the most solar loss events observed in a single year. While most of the reductions before this year have involved only solar resources, there have been a few interesting events in 2024 that have occurred while the solar resources are ramping down for the day, or after the sun has set. These events are capturing undesirable responses from Battery Energy Storage Systems (BESS). These are newer installations that have been connected to the grid under interconnection agreements that prohibit this type of response. The WECC EA team is working with CAISO and NERC on these analyses.





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Technical Activities Report to the Board-December 11, 2024

Energy Emergency Alerts (EEA)

There have been 29 EEA events as of early November 2024, exceeding the 23 that occurred in 2023. In addition to the official EEA events, there were 17 EEA watches in Q3. An EEA watch is a tool used by CAISO when forecasts identify potential operating challenges. Fourteen of these watches in Q3 came from one entity.

Seventeen of the 29 EEA events for the year rose to a Level 3 (the most critical level of EEA, indicating that operating reserves are extremely low) with 11 of these Level 3 events occurring during Winter Storms Gerri and Heather in January. All but one of the Level 3 events in 2024 were reported by two entities. The two entities face unique challenges due their location within the interconnection as well as limitations within their generation fleets.



Status of Ongoing Activities

Base Case Development

Base Case Activity (as of May 16, 2024)		
Base Case Name	Status	Date Posted
2025 Heavy Summer 4	Final	8/28/2024
2034-35 Heavy Winter 1	In Review	8/30/2024
2029-30 Heavy Winter 2	Final	10/1/2024
2034 Light Spring 1	In Review	9/20/2024
2025 Light Summer 1	Final	10/18/2024



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Technical Activities Report to the Board-December 11, 2024

2035 Heavy Summer 1	Final	10/18/2024
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Base Case Data Quality

WECC, in coordination with the base case data submitters, is constantly looking for ways to enhance the data quality of the base cases. One of the model shortcomings targeted this year was missing dynamic generator models. In working with data submitters, we were able to reduce the number of generators without models by about half. This reduction improves the fidelity and accuracy of the dynamic simulations in general and especially for studies looking at conditions close to the generating units that did not have models. The target for reduction of the priority data shortcomings in 2024 is 20%. In the 2025 Heavy Summer 4 case, a reduction of 29% was achieved.

2024 Reliability Assessments

The Western Assessment of Resource Adequacy (Western Assessment) expanded on past years successes and embraced new opportunities for improvement. This 2024 Western Assessment will be published in November as an engaging and interactive web-based format. In addition to the new format, the Western Assessment presents the collective plans for the Western Interconnection and comments on the reasonability of the aggressive resource builds from the Balancing Authorities. The November release of the Western Assessment will share an easy-to-follow overview suitable for all stakeholder audiences. During Q1 of 2025, more technical details will be added as appendixes for interested stakeholders.

WECC contributed to the successful release of the 2024 NERC Summer Reliability Assessment (SRA) with the remaining NERC assessments to be published by the end of the year. The 2024 NERC Long-term Reliability Assessment (LTRA) with Probability Assessment (ProbA) is in final review, and the Winter Reliability Assessment (WRA) will follow shortly after.

Resource Adequacy

In 2023, the ERO RAPA Steering Group finished a strategy document outlining a new future for ERO Interconnection-wide Energy Assessments. The ERO Reliability Assessments Group was subsequently asked to implement this strategy in coordination with the NERC Reliability Assessment Subcommittee (RAS) and the NERC Probabilistic Assessment Working Group (PAWG). One aspect of the energy assessment strategy is for the ERO to use a common approach and software tool for interconnectionwide energy assessments. WECC worked with NERC and the other Regional Entities to select a new tool to perform ERO energy assessments. This new tool will replace WECC's in-house resource adequacy tool, MAVRIC. The group selected Astrapé/PowerGEM's SERVM software, and the ERO Enterprise entities are in the process of obtaining licenses. WECC has a license and is working with Astrapé/PowerGEM to schedule initial training sessions. WECC plans to use SERVM in the ERO assessments and its Western Assessment in 2025. In addition to being WECC's resource adequacy tool,



Technical Activities Report to the Board-December 11, 2024

WECC is also exploring the ability to use SERVM as a production cost model (PCM) for WECC studies and assessments; SERVM would replace Plexos in this capacity.

Building Capabilities

Performance Analysis

A cross-departmental team completed a revised version of the System Performance Data Portal in early September. This is a 2024 scorecard item and provides a new platform that incorporates feedback from a stakeholder focus group. This revised work product offers users simplified navigation, real-time updates, downloadable datasets, and interactive charts. The data portal provides details on system performance, interconnection-level and state statistics, inventory details, amongst other topics.

Electromagnetic Transient Modeling

The proliferation of IBRs in the Western Interconnection poses risks to reliability on several fronts. One of these risks is the inability to accurately predict the behavior of IBRs through traditional power-flow models and study methods. To assess the behavior of IBRs more accurately, Electromagnetic Transient (EMT) models and analyses are required. Early in 2024, WECC contracted with Elevate Energy Consulting to develop a strategy and a roadmap for EMT models and assessments. The team determined that advancing EMT modeling and assessments in the Western Interconnection is an important way WECC can help to address the reliability risks associated with IBRs. To that end, the following declaration encapsulates WECC's aspirations for, and role in, EMT modeling and assessments in our Invented Future:

"WECC is an expert and leader in EMT modeling and simulations to ensure a reliable and resilient Western Interconnection during the rapid transition toward increasing levels of renewable, inverter-based resources."

WECC recently purchased and has been training to use the Power Systems Computer Aided Design (PSCAD) software program as an initial step to gain expertise in EMT modeling and studies. Elevate Energy Consulting will provide a report to WECC by the end of 2024 that will serve as a springboard for engagement with stakeholders in 2025.

Large Loads Assessment

After decades of steady and predictable load growth, new loads such as data centers, crypto mining facilities, and the electrification of buildings and transportation are challenging the grid. These new loads present multiple reliability challenges due to their large size, unpredictability and variability, and their ability to come online very quickly. With little centralized knowledge of these loads, WECC contracted with Elevate Energy to create a better picture of what is meant by the phrase "large load" to assess the risks or concerns posed by each type of large load, to examine what has or is being done already, and to create some "next steps" toward understanding what can and should be done to



Technical Activities Report to the Board-December 11, 2024

manage these loads for reliability. WECC's work with Elevate Energy included stakeholder input, feedback, and partnership through an industry advisory group—a collection of subject matter experts in the industry who are experiencing the impacts of these large loads. This effort with Elevate Energy has almost reached its end, with a report from Elevate due to WECC in November. WECC is finishing the stakeholder communication plan that will happen early in 2025. This is the first step in tackling the dilemmas of large loads in the West with much more to come in 2025 and beyond.

It is important to note that this type of coordination and cooperation with stakeholders to examine the reliability risks associated with large loads is the first of its kind in North America. Several groups, including ESIG and NERC, have only recently created task forces and industry groups to begin examining this new approach. WECC's foundational work in partnership with Elevate Energy and the Advisory Group will help the broader reliability community address these risks more quickly and effectively.



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Technical Activities Update

December 11, 2024

Branden Sudduth, VP RPPA Kris Raper, VP Strategic Engagement Meg Albright, RRC Co-chair Chelsea Loomis, RAC Co-chair



Western Assessment of Resource Adequacy

- Focus areas and key takeaways
 - Demand forecasts are changing drastically on a year-to-year basis
 - New large loads creating reliability challenges
 - Entities planning to add unprecedented amounts of new generation over the next decade
 - With demand growth, new resource delays and cancellations will create serious resource adequacy challenges
 - Variability increasing with the addition of energy limited resources

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Western Assessment of Resource Adequacy

Resource Additions

- More than 172 GW of new generation capacity over the next decade
- More than 85% of that is battery storage, solar, and wind



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Planned Resources in the Western Interconnection

WECC

Western Assessment of Resource Adequacy

Resource Retirements

- 25.85 GW of generation retirements over the next 10 years
- More than 24 GW are baseload generation (e.g., coal, natural gas, nuclear)



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Western Assessment of Resource Adequacy

Sensitivity Analysis

 Build-outs as a percentage of planned resource additions

Context

- Between 2018 and 2023, approximately 76% of the proposed resource additions came online in the year scheduled
- In 2023, 53% of new resources planned to come online at the beginning of the year actually came online

Comparison of Resource Build Out Scenarios



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NERC Long-term Reliability Assessment



WECC

Large Loads Assessment

- Latest emerging major reliability risk
- WECC initiative with Elevate Energy Consulting
- Reliability risk areas
 - Resource Adequacy
 - New operating characteristics
 - Models and studies
 - Interconnection process

WECC



Risk Management Process Enhancements

- Expand stakeholder engagement in the risk management process.
 - Where and when can stakeholders participate?
- Enhance risk register sharing by developing a website dashboard for sharing risks, their priority, and sharing the status of treatment strategies.
- Develop a format for updating and engaging the Board and technical committees on recent changes to the risk register.



Reliability Assessment Committee

- Data and Model Quality Needs
 - Exploring approaches to elevate the focus what is being provided to WECC
 - Example October SRS workshop on the development and maintenance of RAS models
- Long-term Transmission Planning Task Force
 - Extended the timeline for recommendation completion into 2025
 - Timing of stakeholders needing year 20 models
 - To support PCDS and SRS in the development of the Year 20 models

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Reliability Risk Committee

- Risk Work Updates
 - Extreme Natural Event Mitigation Plan Advisory Group
 - Evaluated and added 15 new risks to the register
- 2025 Priorities
 - Support the Risk Management Process Enhancements
 - Populate treatment plans
 - Reevaluate existing risks

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New Risks Added to the Register

- Geomagnetic Disturbance
- Haboobs (Extreme Dust Storm)
- Atmospheric Rivers
- Rising Oceans and Coastal Erosion
- Extreme Winds
- Earthquakes
- Tsunamis
- Volcanic Eruptions
- Adjusted Ambient Temperature Ratings
- Technology Availability Risk
- Increasing Number of Long-term Frequency Deviations
- Forced Oscillations from Battery Energy Storage Systems
- Planning Case Accuracy
- Congested Radio Spectrum
- Electrification: Electric Car & Heating

10

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