WECC

2025 WECC Annual Base Case Compilation and Data Check Report

WECC Staff

February 12, 2026

Executive Summary

WECC conducts the Annual Base Case Compilation and Data Check Program to provide high-quality base cases of the Western Interconnection electric system, as it exists and as it is planned over the next 10 years, for WECC member and staff use. This report includes 11 base cases prepared in 2025. Seven stability simulations and the Steady-state and Dynamics Dashboard (SADD) were used to evaluate each case. The SADD is a list of potential data issues that the System Review Subcommittee (SRS) has identified as important to track in base cases. The stability simulations are used to find potential data issues and reliability risks. Five of the power flow cases were prepared for conducting operating studies and the other five modeled various planning cases out to 2036.

This report summarizes the results of the SADD and the disturbance simulations done by WECC staff, overseen by the SRS and the Reliability Assessment Committee (RAC). For the 2025 WECC Base Case Compilation and Data Check Report (2025 Report), disturbances were spread throughout the Western Interconnection in Northern California, Southern California, Colorado, and Idaho. Some of the disturbances have associated Remedial Action Scheme (RAS) action. All disturbances requiring RAS actions were simulated using in-run programs.

The primary objectives of the 2025 Report are to:

- Assess system model performance by simulating disturbances with a potentially high impact on the system.
- Evaluate the quality of the steady-state data and dynamic transmission system model data that were used to develop WECC base cases.

For the 2025 report, results of disturbance simulations were checked for undamped oscillations and other deviations from standard behavior.

Recommendations

Data submitters should continue to make progress in decreasing the amount of SADD errors, especially missing Balancing Authority Area, missing load long ID, and missing turbine type. NERC Case Quality Metrics that are checked in the SADD should be especially prioritized. Data submitters need to contact WECC staff for models that should be exempt from specific data checks.

Data submitters and WECC staff should strive to resolve late RAS data more promptly. WECC staff should prioritize adhering to the base case compilation schedule dates.

WECC staff should review the prioritized list of power flow model shortcomings and update the targets for 2026.

WECC staff should continue to track the amount of inertia and inverter-based resources being modeled in the base cases.

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Introduction

Each year, WECC performs a Base Case Compilation and Data Check (BCCDC) to create an ongoing assessment of the electric system model of the Western Interconnection in its existing state and for configurations extending 10 years into the future. Base case performance is gauged by transient simulations of high-impact disturbances and through many data check routines, both of which help WECC staff find anomalous data while compiling the cases. If staff finds anomalies, they are logged for future investigation.

The 2025 BCCDC analyzes the base case model data quality by creating the Steady-state and Dynamics Dashboard (SADD) and running several disturbances on the cases used in the 2025 WECC Annual Base Case Compilation and Data Check Report (2025 Report). The SADD compares the data in the power flow and transient stability data to requirements in the Data Preparation Manual (DPM) and the NERC Case Quality Metrics. The log for each case is shown in Appendix A. Appendix B explains the base case naming conventions.

The 2025 report includes lessons learned during the 2025 BCCDC from approved WECC base cases showing system conditions between the winter of 2026 and the summer of 2036. The Results and Recommendations section presents conclusions about the results and recommendations for further action. The General Information section includes information about how WECC staff conducted the studies.

For the 2025 BCCDC, most base cases were compiled to represent system operation under high, but realistic, stress levels. Members of WECC's System Review Subcommittee (SRS) also requested two specialized base cases be built as part of the 2025 BCCDC. Specialized cases can represent the system under atypical conditions, such as severe weather, major equipment outages, or unusual generation patterns, or they can represent more typical system conditions that are not part of the nine recurring cases staff compiles annually. The nine recurring cases are five operating cases and four general 5- to 10-year cases.

The cases reviewed in this report are:

- 26LSP1Sa — 2026 Light Spring 1 Specialized
- 26HW3a — 2026 Heavy Winter 3 Operating
- 26LW1a — 2026 Light Winter 1 Operating
- 26HSP1a — 2026 Heavy Spring 1 Operating
- 31HW2a — 2031 Heavy Winter 2 Typical 5-Year Case
- 31HS2a — 2031 Heavy Summer 2 Typical 5-Year Case
- 26HS3a — 2026 Heavy Summer 3 Operating
- 26LS1a — 2026 Light Summer 1 Operating
- 36HW1a — 2036 Heavy Winter 1 Typical 10-Year Case;
- 36HS1a — 2036 Heavy Summer 1 Typical 10-Year Case
- 26HS4Sa — 2026 Heavy Summer 4 Specialized

The specialized cases were both compiled to study a near-term case with very high inverter-based resources in California and with high flows from California to Northwest.

Disturbances Performed

Seven out of eight disturbances were run on each base case created in the 2025 BCCDC. Either the loss of two Palo Verde generating units or a bi-pole Pacific Direct Current Intertie (PDCI) outage was run on the case, depending on the direction of flow on the California Oregon Intertie (COI).

The 2025 report included these disturbances:

1. 30-cycle insertion of Chief Joseph braking resistor ("ringdown")
2. Three-phase fault at Comanche and loss of the Daniels Park–Comanche 1 and 2 345-kV lines
3. Three-phase fault at Colorado River and loss of Colorado River–Red Bluff 1 and 2 500-kV lines
4. Three-phase fault at Hells Canyon and loss of Brownlee–Hells Canyon 230-kV line
5. Three-phase fault at Midway and loss of Gates–Midway #1 and Diablo–Midway #2 500-kV lines
6. Three-phase fault at Imperial Valley and loss of North Gila–Imperial Valley 500-kV lines
7. Loss of two Palo Verde generating units
8. Bi-pole PDCI outage

Results and Recommendations

SADD Totals

The SADD is a list of data issues regarded by the SRS as important to track in base cases. WECC staff creates two versions of the SADD for each base case. The first is sent out with the initial version of the case for data submitters to review and correct any issues in their data. Data submitters then submit changes for inclusion in the final, approved version of the case. WECC staff creates the second version of the SADD based on the final version of each base case as a way for data submitters to track whether their updates are fixing data issues. The following figure reflects only the versions of the SADD created for the final version of each case. The cases are listed in chronological order by the date of the original data request. All cases were built as part of the 2025 WECC Base Case Compilation Schedule (BCCS).

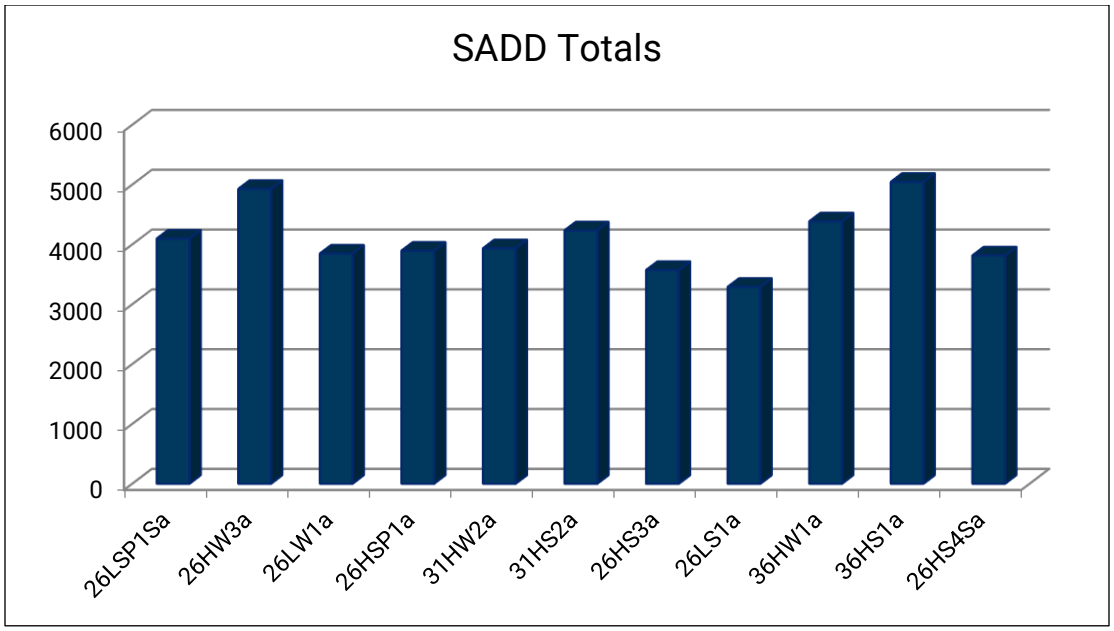

Figure 1: 2025 BCCDC SADD Totals

Recommendation

SADD totals have continued to decrease year by year, from an average of 11,291 in 2022 down to 4,094 in 2025. A large driver for the decrease in SADD errors is data submitters populating the Balancing Authority Area (BAA) fields more often, going from 964 missing BAAs on average in 2024 to 202 in 2025. The case with the most SADD errors in the 2025 BCCDC was the 36HS1a. This is not surprising since that case was built to represent the year 2036 and inherently involves more uncertainty than near-term cases. However, the 26HW3a was not far behind the 36HS1a in terms of total SADD errors, and this is concerning because the 26HW3a was built to represent a near-term operations horizon and, therefore, should have much less uncertainty. The 26HW3a had 1,281 missing BAAs, which was well above the average of 202 for the 2025 BCCDC, and that likely contributed to its large number of SADD errors.

WECC staff recommend that data submitters continue to prioritize reducing SADD totals. Additionally, data submitters should review the SADD sent with the initial version of the base cases to ensure that corrections make it into the final version of the base cases. Additionally, data submitters should review the final versions of the SADD case by case for consistency across data submissions to help reduce anomalies like the unusually high number of missing BAAs in the 26HW3a.

Scorecard Metrics

WECC's board of directors issued a directive as part of WECC's 2025 Corporate Scorecard to prioritize and reduce shortcomings in power flow models by 20%. WECC staff proposed the following prioritized list of power flow model shortcomings for 2025:

1. Reduce the amount of generator terminal bus voltages outside the range of 0.95 to 1.05 pu when regulating a non-terminal bus.

2. Reduce the amount of loads missing long ID.
3. Reduce the amount of loads missing BAA.
4. Reduce the amount of generators missing turbine type.

WECC staff and data submitters achieved a 98% reduction of the prioritized errors, as summarized in the following table. The cases used for comparison to determine completion were the heavy summer operating cases from the 2024 and 2025 BCCDCs; specifically, the 25HS4a for the 2024 BCCDC and the 26HS3a for the 2025 BCCDC. The large reduction was achieved primarily by WECC staff automatically populating many loads missing BAA based on the best information available, such as using the BAA of the bus the load was connected to or the area in which the load was located.

Table 1: Prioritized Power Flow Shortcomings

Priorities	2025 Heavy Summer 4 Tabulation	2026 Heavy Summer 3 Tabulation
Generator terminal bus voltage	84	43
Load missing long ID	253	22
Load missing BAA	4026	2
Generator missing turbine type	109	20
TOTAL	4472	87
GOAL (2025 heavy summer tabulation)	3578	Achieved (98% reduction)

Recommendation

WECC staff should continue to monitor and update the prioritized list, informed by the NERC Case Quality Metrics and SADD. WECC staff should look for further opportunities for automation to reduce the number of errors on the prioritized list.

NERC Case Quality Metrics

NERC annually publishes a report detailing base case error counts for certain metrics that NERC considers important. The report's recommendations are directed to each interconnection's MOD-032 designee, which is WECC for the Western Interconnection. As of the 2025 BCCDC, most NERC case quality metrics have been incorporated directly into the SADD for data submitters to review; however, data submitters should still familiarize themselves with the case quality metrics for those that are not captured in the SADD. Some of the main metrics driving error counts in the Western Interconnection include generators without models, suspect generator reactive limit power factors, and unreasonable saturation factors. The following figure shows the NERC Case Quality Metrics totals for the 2025 BCCDC.

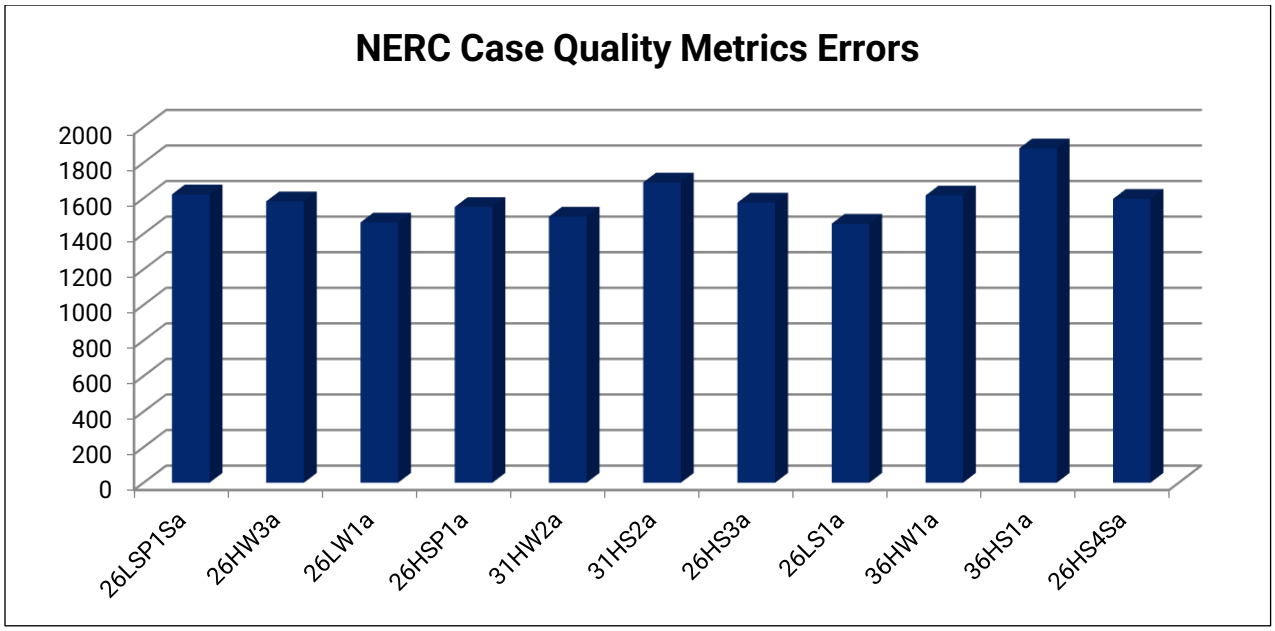

Figure 2: 2025 BCCDC NERC Case Quality Metrics Totals

Recommendation

WECC staff and data submitters are making progress on some NERC Case Quality metrics, but the year-by-year average of NERC Case Quality Metrics totals tracked in the SADD is relatively constant. WECC staff should continue to use the totals to inform which issues are prioritized for improvement in the 2026 BCCDC. Additionally, data submitters should familiarize themselves with the report and metrics because outside of WECC's obligation as the Western Interconnection MOD-032 designee, the NERC Case Quality Metrics report is not widely discussed. Furthermore, data submitters should review their data that is being flagged in the SADD under NERC Case Quality Metrics and coordinate with WECC staff to whitelist correct data.

Inertia

WECC's 2021-22 Study Program recommended that the SRS track the amount of inertia in base cases. Figure 3 shows the inertia in GVA-seconds for each case in the 2025 BCCDC in chronological order of the time the case is intended to model. Figure 4 shows the system frequency response to a loss of two Palo Verde generators at a 500 kV bus in California using the heavy summer operating case. The nadir of the frequency drop is well above the 59.5 Hz threshold for underfrequency load shedding for each case plotted.

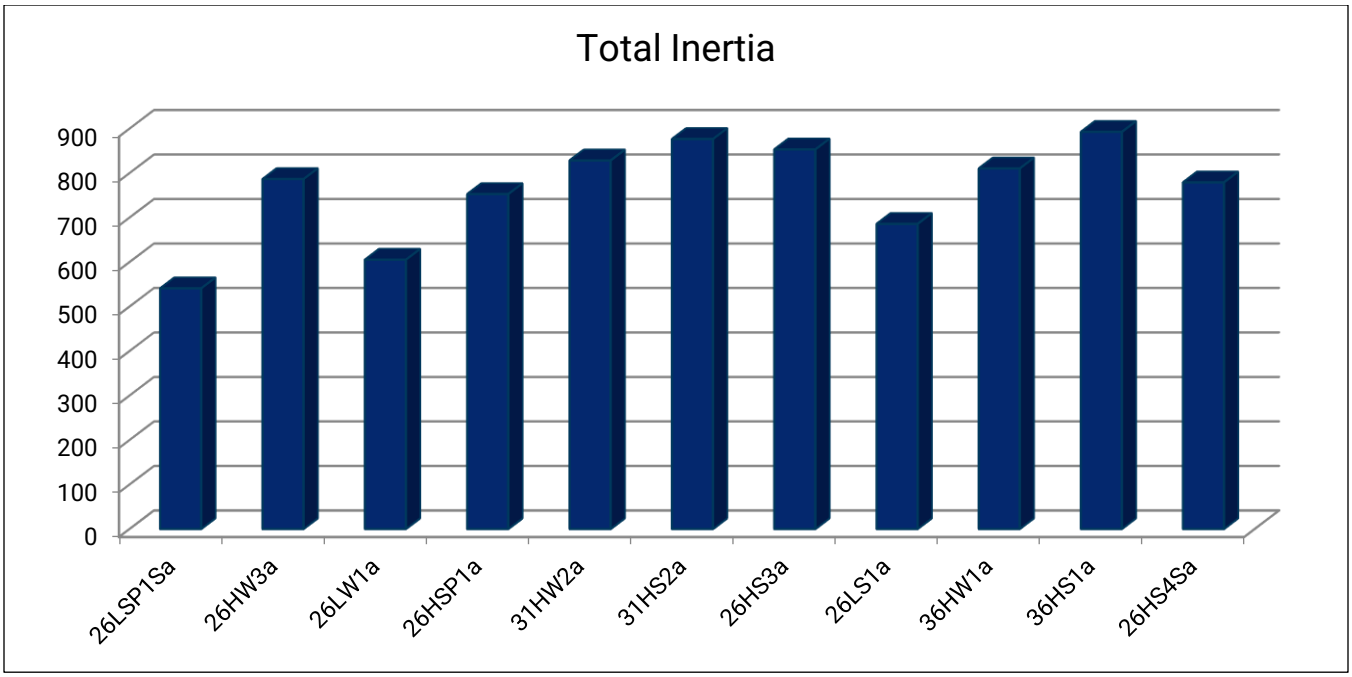

Figure 3: 2025 BCCDC Inertia Totals

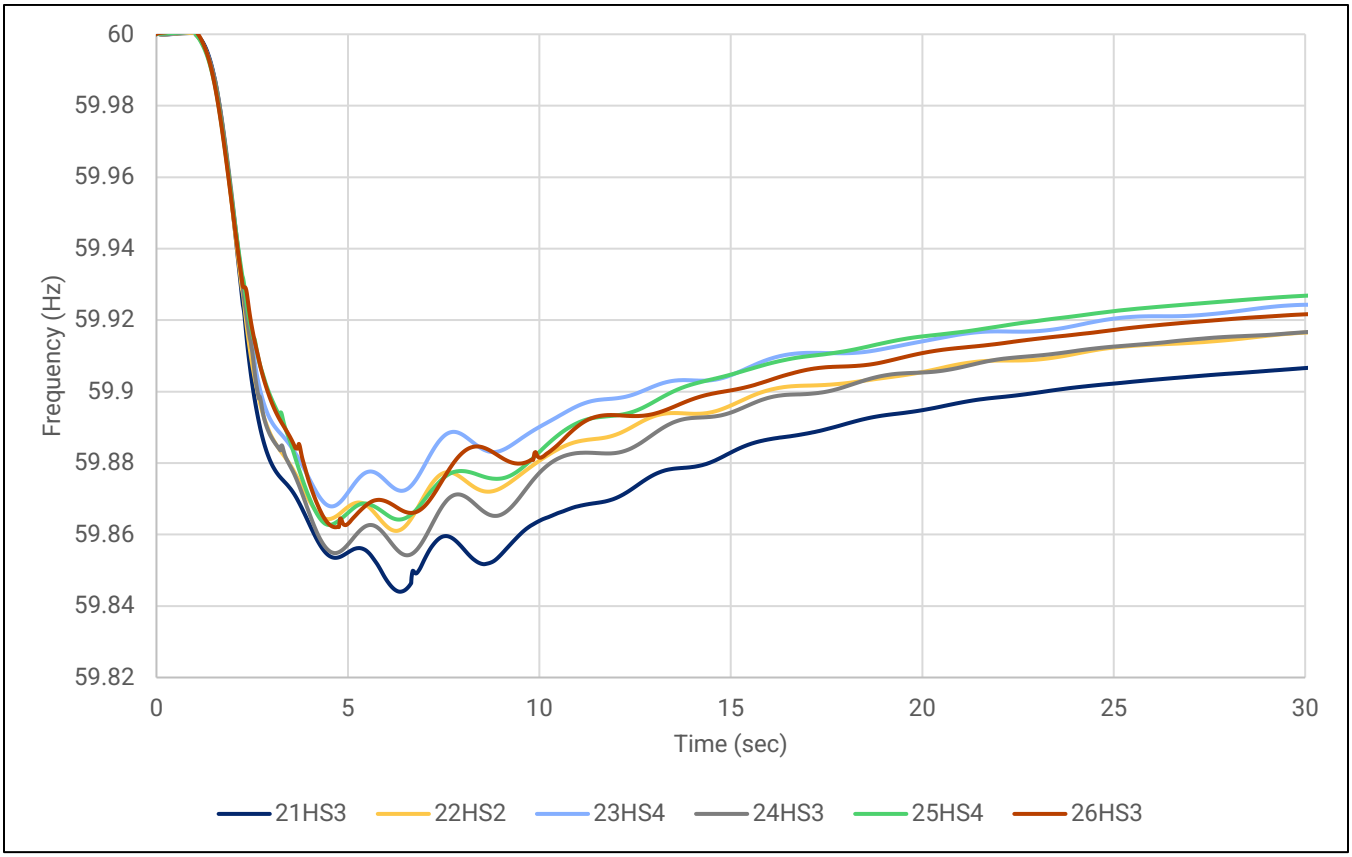

Figure 4: Double Palo Verde Frequency Response

Recommendation

WECC staff should continue to monitor the inertia and Double Palo Verde outage system response for potential risks to reliability.

Inverter-based Resources

As the resource mix continues to change in the Western Interconnection, tracking amounts of distributed generation (DG) as well as inverter-based resources like wind and solar will be crucial to ensure those components are being modeled in reasonable amounts in base cases. **Error! Reference source not found.** shows the amount of DG, solar, and wind in gigawatts that is online in each case in the 2025 BCCDC, arranged from nearest to furthest in the future.

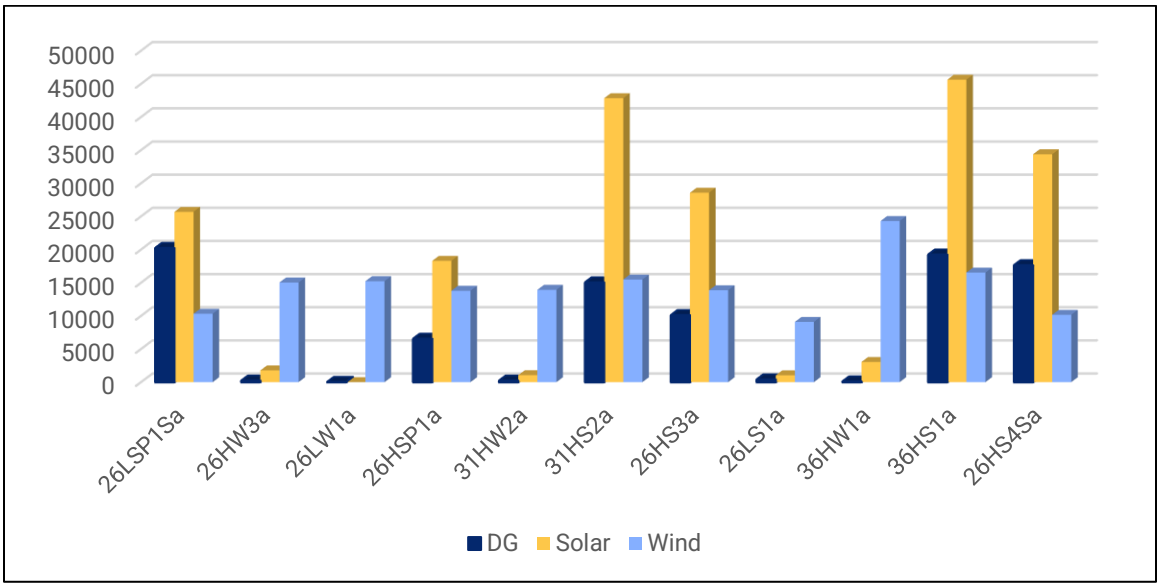

Figure 5: 2025 BCCDC IBR Totals

Recommendation

WECC staff should continue to track the amount of inverter-based resources in each case.

Late Data

WECC staff maintains a log of late data received for each case. Late data can make it difficult to assemble a case on time due to complications that arise when attempting to integrate new data into a partially compiled case that staff has already started working on. The late data log also includes cases that WECC published late and a column to discuss observed data quality issues that WECC staff observed. Additionally, the late data log tracks mismatched area interchanges and entities whose RAS files loaded into operating cases with issues.

Recommendation

In the 2025 BCCDC, only two areas were late for more than one submission. SunZia, in particular, did not submit data for a single case after becoming an area in February. This is not acceptable from an area coordinator.

Data submitters quickly resolved mismatched interchanges. Late RAS data continued to be an issue in the 2025 BCCDC, however, with three out of five operating cases showing late RAS. Data submitters should proactively review their RAS for errors in the initial base case submission and in the final submission. WECC staff should work with data submitters to identify the RAS errors earlier in the process so updates can be included with final data submissions.

Additionally, WECC staff published all but two cases late. Late cases on WECC's part also put pressure on data submitters by delaying their review and potentially causing overlaps with other case preparation activities. WECC staff should strive to publish cases on time and ensure base case builders are fully trained.

2024 Report Review

This section will examine the recommendations from the 2024 Report and progress made toward those recommendations. The first recommendation from the 2024 Report was for data submitters to review each SADD to ensure that data fixes propagate throughout cases, and to review the logs WECC staff prepares for each case prior to preparing changes to be incorporated into the final version of each case. The 2025 BCCDC showed an improvement in SADD totals on average, indicating success in this recommendation. However, some errors continue to be an issue only for certain cases, such as missing BAA. Data submitters should continue to review each SADD for anomalies and submit corrections as needed.

The second recommendation from the 2024 Report was for WECC staff to update the prioritized list of power flow shortcomings for the 2025 BCCDC. WECC staff achieved this recommendation.

The third recommendation from the 2024 Report was for WECC staff and data submitters to work together to prioritize reducing NERC Case Quality Metrics. This recommendation was partly achieved through reductions in overall SADD errors, which include many NERC Case Quality Metrics. However, this should continue to be a focus area to ensure WECC is meeting its obligations as the MOD-032 designated Interconnection-wide Base Case Builder.

The fourth recommendation from the 2024 Report was for WECC staff and data submitters to reduce the amount of late data. This recommendation was largely achieved in the 2025 BCCDC for data requests and interchange coordination. However, late RAS data continued to be an issue. WECC staff and data submitters should prioritize on-time RAS data for the 2026 BCCDC.

The sixth recommendation from the 2024 Report was to track the amount of inertia in the heavy summer cases. This recommendation was followed in the 2025 Report, and WECC staff should continue to track inertia.

The seventh recommendation from the 2024 Report was to track the capacity of inverter-based resources in each case. This recommendation was followed in the 2025 Report, and WECC staff should continue to track the amount of inverter-based resources.

General Information

For the 2025 Report, disturbances were run on 11 power flow base cases. Stability simulations were run on all cases in the 2025 BCCDC.

1. The power flow, stability, and post-transient simulations for the 2025 BCCDC were conducted on a PC using the Microsoft Windows 11 operating system and Version 23.0.8 of the General Electric (GE) Positive Sequence Load Flow (PSLF) software program.
2. All 2025 Report disturbance simulations were run with the governor response represented in the power flow (base load flag) and dynamic data (governor models) provided.
3. For the 2025 Report disturbance simulations, Phase 2 of the composite load model, which includes single-phase motor stalling, was used. Models were generated using either the climate zone representation or the load-specific representation.
4. For all the 2025 cases, DG was included in the load data, and DG dynamics data was modeled with the DER_A model in the composite load model.

As part of the 2025 base case development, data-check routines, along with stability studies, were run to find potential data errors.

Objectives

The following section addresses each objective developed in the 2025 BCCDC Scope of Work. The objective is stated, followed by the findings and actions related to it.

Base Case Development

The first objective is the development of steady-state and dynamic base case models.

Actions and Findings

The 11 power flow base cases and stability data files were created for the 10-year data bank. The 11 cases include five operating cases, two specialized cases, and four typical planning cases. The cases are available to WECC members on wecc.org.

Model Performance Assessment

The second objective is to annually assess the performance of the transmission system model based on selective disturbances run using the cases.

Actions and Findings

1. A no-disturbance simulation was done on each case. Data for machines with significant oscillatory behavior were revised. The results for the cases compiled during 2025 for the WECC 10-year power flow and stability data bank showed no significant oscillatory behavior after changes were made.
2. After additions and changes to the master dynamics file, a 35-second simulation of a "ringdown" (30-cycle insertion of Chief Joseph braking resistor) case was done.
3. One standard disturbance was run on each case to tune the dynamic and power flow data. Tripping of two Palo Verde units was simulated as the standard disturbance on cases with north-to-south flows on the COI. For cases with south-to-north flows, loss of the PDCI was simulated. If the standard disturbance results were not stable, changes were made to the base case to correct data problems or flows outside of known operating limits.

4. Seven disturbances were run on each case, and the results of the stability studies were checked for system data or modeling problems. Any issues found were logged in the files included with each case. WECC urges data submitters to review the logs and submit corrections to models shown as being unstable when stressed by these disturbances.
5. Each power flow base case was checked relative to known transfer capabilities and nomograms. Transfers in each of the power flow cases for the 2025 BCCDC were within the estimated transfer capability and nomogram limits at the time they were compiled.

Disturbance Summary

Table 2 shows the stability studies that were conducted and associated their RAS.

Table 2: Disturbance Summary

Fault Location	Elements Removed	Remedial/Relay Action
COMMANCHE 345-kV SUBSTATION	**Time (cycles) Switching** 60 Three-Phase Comanche 345-kV fault 64 Clear the fault after four cycles and open the Comanche–Daniel Park 345-kV Lines 1 and 2 Study terminated at 35 seconds	None
COLORADO RIVER 500-kV SUBSTATION	**Time (cycles) Switching** 60 Three-Phase Colorado River 500-kV fault 64 Clear the fault after four cycles and open the Colorado River–Red Bluff 500-kV lines 1 and 2 Study terminated at 35 seconds	None
HELLS CANYON 230-kV SUBSTATION	**Time (cycles) Switching** 60 Three-Phase Hells Canyon 230-kV fault 65 Clear the fault after five cycles and open the Hells Canyon–Brownlee 230-kV Line Study terminated at 35 seconds	Hells Canyon Generator Tripping

Fault Location	Elements Removed	Remedial/Relay Action
MIDWAY 500-kV SUBSTATION	**Time (cycles) Switching** 60 Three-Phase Midway 500-kV fault 64 Clear the fault after four cycles and open the Midway–Vincent 500-kV sections 1 and 2 and Midway–Diablo 500-kV line 2 Study terminated at 35 seconds	None
IMPERIAL VALLEY 500-kV SUBSTATION	**Time (cycles) Switching** 60 Three-Phase Imperial Valley 500-kV fault 64 Clear the fault after four cycles and open the Imperial Valley–North Gila 500-kV line Study terminated at 35 seconds	None
DOUBLE PALO VERDE UNIT OUTAGE	**Time (cycles) Switching** 60 Trip 2 Palo Verde Generators Study terminated at 35 seconds	Trip load associated with the loss of 2 Palo Verde units
CHIEF JOSEPH RESISTOR INSERTION	**Time (cycles) Switching** 60 Insert Chief Joseph Braking Resistor 90 Clear the Chief Joseph Braking Resistor Study terminated at 35 seconds	None
BI-POLE PACIFIC DC INTERTIE OUTAGE	**Time (cycles) Switching** 60 Open two DC Lines from Sylmar to Celilo Study terminated at 35 seconds	None

More details on the results of power flow cases and disturbance simulations are in the appendices. Appendix A includes summary information from the SADD for each power flow case. Appendix B explains the base case naming conventions used in this document.

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