

Day 1—September 11, 2024
1:00 p.m. to 5:00 p.m. MT

1. Welcome, Call to Order

Song Wang, Modeling and Validation Subcommittee (MVS) Chair, called the meeting to order at 1:00 p.m. MT on September 11, 2024. A quorum was present to conduct business. A list of attendees is attached as Exhibit A.

2. Review WECC Antitrust Policy

Doug Tucker, Senior Engineer, read aloud the WECC Antitrust Policy statement. The meeting agenda included a link to the posted policy.

3. Approve Agenda

S. Wang introduced the proposed meeting agenda.

The 2024-09-11 MVS Agenda was amended as follows:

- “EV Charging Model/Data Center,” “Advanced Pump Storage Model,” and “Electrolyzer Model” were added to Item 9’s model development list.
- “Case Studies” was changed to “Utility and System Operator Case Studies to Identify Value Proposition of GFM Inverters” on Item 10.

By consensus, the MVS approved the agenda.

4. Review and Approve Previous Meeting Minutes

S. Wang introduced the minutes from the meeting on May 22-24, 2024.

The 2024-05-22 MVS Minutes were amended as follows:

- “He demonstrated that only the lower order harmonics play a significant role in determining the eigenvalues of the system, and that in almost all cases, the use of the positive sequence software, such as GE’s PSLF, is sufficient. There will be cases in remote weak areas of the system (i.e., low short circuit ratio) where the EMTP will be needed for a complete accurate evaluation, but those should be special cases only. So, a conclusion seemed to be that currently positive sequence models work well enough to capture the significant behaviors.” was added to Item Four.

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- “The model is based on an IEEE paper by D. L. Goldsworthy, “A linearized model for MOV-protected series capacitors,” IEEE Transactions on Power Systems, Vol. PWRs-2, No. 4, November 1987. It describes a model that has transitions between three operating modes. NORMAL (Mode 0): use the $R_{cap} + jX_{cap}$ from the power flow case. CAP+MOV (Mode 1): use a special $R_{pc} + jX_{pc}$ curve empirically determined and presented in the 1987 paper. BYPASS (Mode 2): Assume the bypass switch has operated and treat as a near zero impedance.” was added to Item 9.
- “The IBR short circuit current magnitudes continued from 6 cycles to 21 cycles after the system fault was removed, in strict contrast to the behavior of synchronous machines.” was added to Item 13.
- “It was concluded that a single DER aggregation model is unlikely to be sufficient.” was added to Item 14.
- “and concluded that SSR or harmonics need the EMT, but for simple voltage-ride-through events the positive sequence model is sufficient.” was added to Item 16.

By consensus, the MVS approved the minutes from May 22-24, 2024.

5. Review Previous Action Items

D. Tucker reviewed action items carried over from the MVS meeting on May 24, 2024. Action items that are not closed and will be carried forward can be found [here](#).

6. Review Approved Dynamic Model List

D. Tucker reviewed the approved dynamic model list with the MVS.

The Excel spreadsheet can be found on the WECC website.

7. Review MVS Member List and Update

D. Tucker reviewed the MVS member list and encouraged present organizations to check whether their membership records are up to date.

8. Addressing Bus Flow Challenges in Substations: Findings and Recommendations for WECC Members

Jameson Thornton, Burns & McDonnell, presented the findings and recommendations for addressing bus flow challenges in substations. They defined a “bus flow” as breaker-node modeling for a single substation in a branch-bus case, described how they choose a substation to screen, and presented the additional changes needed to continue accurate screening. J. Thornton considered the following mitigation options to be operational changes, capacity increases, flow limits, and station splitting.



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The presentation can be found on the WECC website.

9. Prioritizing the Next Set of Model Development

The MVS agreed to prioritize the following set of model development, in order of most important to least important:

- VHVDC2
- IBR Controls— REEC_E
- Grid-forming Inverter Model – Hybrid
- EV Charging Model/Data Center
- VHVDC3 – Off-shore Wind
- Advanced Pump Storage Model
- SVSMO4 Model
- SCMOV (series capacitor MOV model)
- Multi-terminal VSC-HVDC
- Electrolyzer model

Day 2—September 12, 2024

9:00 a.m. to 5:00 p.m.

10. Renewable Energy Modeling

The MVS listened to the following presentations:

- Pouyan Pourbeik, PEACE, updated the group on IBR model development. The REEC_E model is ready and available in PSSE and TSAT—the results match in both tools. GE PSLF, PowerWorld, and DigSilent PowerFactory model types are almost done on the model implementation. P. Pourbeik recommends approving the IBR model development in the next MVS meeting.
- Wei Du, PNNL, Sai Gopal Vennelaganti, Tesla, and Deepak Ramasubramanian, EPRI, discussed the preliminary model specification of a grid-forming and grid-following hybrid IBR model.
- Songzhe Zhu, Qualus, and S. Wang presented a clarification of the applicability of the generic models, user-defined model, and EMT model. The MVS discussed the WECC document development plan and the specification of user-defined model requirement.
- S. Zhu discussed updating IBR modeling documents to incorporate and clarify recent progress. She provided a list of approved documents, needs for updated documents, and proposed updates for IBR modeling documents.
- Deepak Ramasubramanian, EPRI, presented on utility and system operator case studies to identify the value of GFM inverters.



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- Dmitry Kosterev and Eric Heredia, BPA, led a discussion on benchmark model datasets.
- The MVS discussed offshore wind model development. S. Wang is gathering a small team from multiple entities to work on this project. They decided to keep this item on the agenda and provide updates on offshore wind model development.

The presentations can be found on the WECC website.

11. Load Modeling

- Nick Hatton, WECC, presented on PSLF modular model validation. The MVS discussed the process to finalize the official switch to the modular model. They agreed to bring this topic back as an approval item at the next MVS meeting.
- Boyuan Xie, Xiaokang Xu, and Byoungkon Choi, S&C, presented on the PJM system stability assessment using composite load and distributed energy resource models.
- Lakshmi Sundaresh discussed the modeling of electronic loads for planning studies. She shared next steps for the planning studies with the MVS.
- Andreas Schmitt and S. Wang presented the following load modeling work plan:
 - Transition the load model to a modular-based structure,
 - Parameter calibration,
 - Testing and verification, including equipment testing and model performance verification based on system events or other methods,
 - WECC load model composition data,
 - System-wide simulation,
 - EV and data center control and protection, and
 - Support NERC emerging load plans.

The presentations can be found on the WECC website.

Day 3—September 13, 2024

9:00 a.m. to 1:00 p.m.

12. Active Transmission System Modeling Update

P. Pourbeik gave an overview of active transmission system modeling, particularly the following models:

- vhwdc2
- vhwdc3
- svsmo4

The presentation can be found on the WECC website.



13. Power Plant Modeling

- Quincy Wang, BC Hydro, presented the K_{is} factor and its effect on the synchronous machine on-load field current. He suggested an improvement for the existing saturation function and an investigation of the function mechanism of K_{is} in more detail to develop a more accurate model.
- The MVS discussed the excitation system Type C model.
- Jin Tan, NERL, presented APSH specification development updates. NERL shared the development timeline and encouraged feedback from the MVS.

The presentations can be found on the WECC website.

14. MOD-33 Update

- Licheng Jin, CAISO, provided an RC West update. RC West posted three cases in the RC portal for entities' reference; L. Jin encouraged them to post the cases on their utilities' websites.
- D. Tucker provided an SPP update—they are currently working on the MOD-33 case and hope it will be released before the end of the year.

The presentations can be found on the WECC website.

15. Program Updates

- Mengxi Chen, GE, provided PSLF program updates. They do not have any major releases soon.
- Jay Senthil, PTI, provided PSSE program updates. He shared the recent and upcoming PSSE releases and dynamics enhancements.
- Jamie Weber, PowerWorld, provided PowerWorld program updates. They uploaded models the MVS has been working on and continue to prepare for their next release in the next month or so.
- Jeff Bloemink, Powertech Labs, provided Powertech Labs TSAT program updates. They are implementing enhancements to their systems.

The presentations can be found on the WECC website.

16. Public Comment

S. Wang brought the MVS's attention to Item 9, "Prioritizing the Next Set of Model Development," to rearrange and add additional models.

Bo Gong, Salt River Project, requested that the MVS add an agenda item for the MVS's next meeting to present on the pros and cons of submitting user-written models to WECC to build generator unit models. MVS membership will vote on the proposal in the next meeting.



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Eric Bahr, Northwestern Energy, asked what the process is to retire a model. D. Tucker and J. Weber responded to reach out to D. Tucker, and he can mark the model as retired on the master list.

17. Review New Action Items

- Coordinate with Songzhe Zhu on updating the hybrid plant model guideline.
 - Assigned To: Pouyan Pourbeik
 - Due Date: January 31, 2025
- Send letter to responsible TPs for unapproved models in MDF
 - Assigned To: Doug Tucker and Song Wang
 - Due Date: January 31, 2025
- Send Doodle Poll to MVS for 2025 meeting dates
 - Assigned To: Doug Tucker and Maya Brimhall
 - Due Date: October 4, 2024
- Prepare presentation and schedule approval item for next MVS meeting
 - Assigned To: Bo Gong
 - Due Date: January 31, 2025

18. Upcoming Meetings

January 29–31, 2025 Virtual
May 7–9, 2025 Salt Lake City, Utah
September 10–12, 2025 Virtual

19. Adjourn

S. Wang adjourned the meeting without objection at 1:00 p.m.



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Exhibit A: Attendance List

Members in Attendance

Angel Aquino..... PowerWorld Corporation
Hassan Baklou..... San Diego Gas and Electric
Zachary Beus..... Puget Sound Energy, Inc.
Kevin Brooks..... Southern California Edison Company
Sean Brosig..... US Army Corps of Engineers
Emerson Butler..... Puget Sound Energy, Inc.
Daniel Cervantes..... Los Angeles Department of Water and Power
Lakmal Chandrasekara..... Turlock Irrigation District
Ken Che..... Public Utility District No. 1 of Snohomish County
Mengxi Chen..... GE Vernova (GE Energy Consulting Group)
Christopher Corral..... El Paso Electric Company
Jackson Daly..... Idaho Power Company
Tuan Dang..... Public Utility District No. 1 of Snohomish County
Fangfang Du..... PacifiCorp
Wei Du..... Pacific Northwest National Laboratory
Xiaoyuan Fan..... Pacific Northwest National Laboratory
Roberto Favela..... El Paso Electric Company
Jonathon Flores..... Los Angeles Department of Water and Power
Carlos Flores Lopez..... US Army Corps of Engineers
Christopher Fuchs..... California Independent System Operator
Miguel Garcia..... Sacramento Municipal Utility District
Chris Gilden..... Tri-State Generation and Transmission—Reliability
Joseph Gillette..... Utility System Efficiencies, Inc.
Bo Gong..... Salt River Project
Robert Jackson..... Burns & McDonnell (1898 and Co.)
Licheng Jin..... California Independent System Operator



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Robert Jones..... Seattle City Light
Lesley Kayser-Sprouse..... Hetch Hetchy Water and Power
James Keller..... Western Area Power Administration - Rocky Mountain Region
Seong Tae Kim PacifiCorp
Slaven Kincic Pacific Northwest National Laboratory
Yuriy Komlev U.S. Bureau of Reclamation
Dmitry Kosterev Bonneville Power Administration—Transmission
May Le..... Public Utility District No. 2 of Grant County
Mitchell Miller..... NorthWestern Energy
Parag Mitra Electric Power Research Institute
Saurav Mohapatra PowerWorld Corporation
Pouyan Pourbeik Power and Energy, Analysis, Consulting and Education, PLLC
Sergey Pustovit Bonneville Power Administration
Deepak Ramasubramanian Electric Power Research Institute
Anthony Rendon Salt River Project
Amanuel Selassie..... Los Angeles Department of Water and Power
Jayapalan (Jay) Senthil Siemens Energy, Inc.
Jonathan Stahlhut TransCo Energy, LLC
Spencer Tacke..... Auriga Corporation
Chifong Thomas Thomas Grid Advisor
Doug Tucker..... WECC
Ramin Vakili..... GE Vernova (GE Energy Consulting Group)
GuiHua Wang British Columbia Hydro and Power Authority
Song Wang..... Portland General Electric Company
Jeffery Watkins..... NV Energy
Maggie Watkins U.S. Army Corps of Engineers-Seattle District
James Weber PowerWorld Corporation
Trevor Werho Arizona Public Service Company



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Xiaofei (Sophie) Xu..... Pacific Gas and Electric Company
Steve YangBonneville Power Administration—Transmission
Ratanan Yoopat..... Bonneville Power Administration
George Zhou..... S&C Electric Company
Songzhe Zhu..... GridBright, Inc.
Jess BoatwrightNorthWestern Energy

Members not in Attendance

Jim Ding British Columbia Hydro and Power Authority
Chris Effiong Western Area Power Administration
Allison Hidalgo..... U.S. Bureau of Reclamation
Gordon Kawaley.....Bonneville Power Administration—Transmission
Ron Markham Pacific Gas and Electric Company
Nathan Powell..... Deseret Generation & Transmission Cooperative
Tracy Rolstad.....Public Utility District No. 2 of Grant County
Hari Singh.....Public Service Company of Colorado (Xcel Energy)
Patrick Truong Sacramento Municipal Utility District
Shounak Abhyankar.....ISO New England

Others in Attendance

Leon Atkinson.....Salt River Project
Eric Bahr.....NorthWestern Energy
Steven Barnes Peregrine Engineering
Jeff BloeminkPowertech Labs
Maya Brimhall.....WECC
Gregory Brooks U.S. Army Corps of Engineers
Theo BrownSouthwest Power Pool
Jared Campbell.....Electrical Consultants, Inc.
Malati Chaudhary.....Public Service Company of New Mexico
Yunzhi Cheng..... Electric Reliability Council of Texas



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Alejandro Conti..... Mitsubishi Electric Power Products, Inc.
Hamzeh Davarikia Electric Reliability Council of Texas
Nick DetmerXcel Energy
William Dull.....U.S. Army Corps of Engineers - Walla Walla District
Mohamed El KhatibInvenergy
Donna Enriquez..... El Paso Electric Company
Tony Faris Bonneville Power Administration
Bryan Friesen..... British Columbia Hydro and Power Authority
Alan Gao Quanta Technology, LLC
Ningchao GaoNational Renewable Energy Laboratory
Jack Gibfried..... NERC
Ivan Guerrero..... El Paso Electric Company
Beichen Guo..... Electric Reliability Council of Texas
Sheikh Hassan..... Sacramento Municipal Utility District
Nick HattonWECC
Eric Heredia..... Bonneville Power Administration
Adrian Horner.....Xcel Energy
Stephen Jenkins.....Public Service Company of New Mexico
Jinho Kim Pacific Northwest National Laboratory
Dan Leonard..... Peregrine Engineering
Sam Li..... British Columbia Hydro and Power Authority
Wei LiPower Tech Labs
James MacPherson..... Avantus Technology
Richard Maguire Electrical Consultants, Inc.
Cole MaresSalt River Project
Justin Michlig.....Public Service Company of Colorado (Xcel Energy)
Elliot Mitchell-Colgan..... Bonneville Power Administration
Shawn Patterson U.S. Bureau of Reclamation



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Juan Placid JJ Power and Energy
Logan Pokallus..... Western Area Power Administration
Amro Quedan Electric Reliability Council of Texas
Abner Ramirez Kestrel Power Engineering
Benjamin Rodriguez..... El Paso Electric Company
Ricardo Rodriguez..... El Paso Electric Company
Nolan Rogers.....PacifiCorp
Marco Salazar..... Siemens Energy, Inc.
Juan Sanchez-Gasca..... Independent Subject Matter Expert
Liam Segarty..... British Columbia Hydro and Power Authority
Alex Shattuck NERC
Austin Shaver..... Electric Reliability Council of Texas
Lakshmi Sundaresh.....Electric Power Research Institute
Jin TanNational Renewable Energy Laboratory
Anthony Taylor..... Black Hills Energy
Sushrut Thakar.....Electric Power Research Institute
Jerry Thompson Kestrel Power Engineering
Jameson Thornton Burns & McDonnell (1898 and Co.)
David Tovar..... El Paso Electric Company
John Undrill..... Independent Subject Matter Expert
Jerod Vandehey..... Public Utility District No. 1 of Cowlitz County
Sai Gopal Vennelaganti Tesla, Inc.
Juan Vicente..... El Paso Electric Company
Quincy Wang British Columbia Hydro and Power Authority
Xiaoyu (Shawn) Wang.....Enel North America, Inc
Zhibo Wang..... Mitsubishi Electric Power Products, Inc.
Boyuan Xie..... S&C Electric Company
Xiaokang Xu S&C Electric Company



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Armando Yanez Peralta.....Salt River Project
Chuanjiang (Chelsea) Zhu..... National Grid USA Service Company, Inc.
Wenchun Zhu..... Siemens Energy, Inc.
Scott Zuloaga..... Electric Reliability Council of Texas

