NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

NERC EMTTF Updates

Supporting Widespread Adoption of EMT Modeling

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ESIG Fall Workshop
October 23, 2024

Outline

- EMTTF Strategy
- EMTTF Supporting EMT Adoption across North America
- NERC EMTTF Work Items Overview
- NERC Reliability Guidelines on EMT Modeling and Studies
- NERC EMTTF Work Items Updates
- Looking ahead to 2025

EMTTF Strategy

- Goal:
  - Widespread adoption of EMT modeling tool in interconnection and planning studies
- Approach:
  - Make EMT modeling more accessible and approachable
  - Create common understanding
  - Promote motivation
  - Decouple from other processes
  - Create a baseline, unified approach

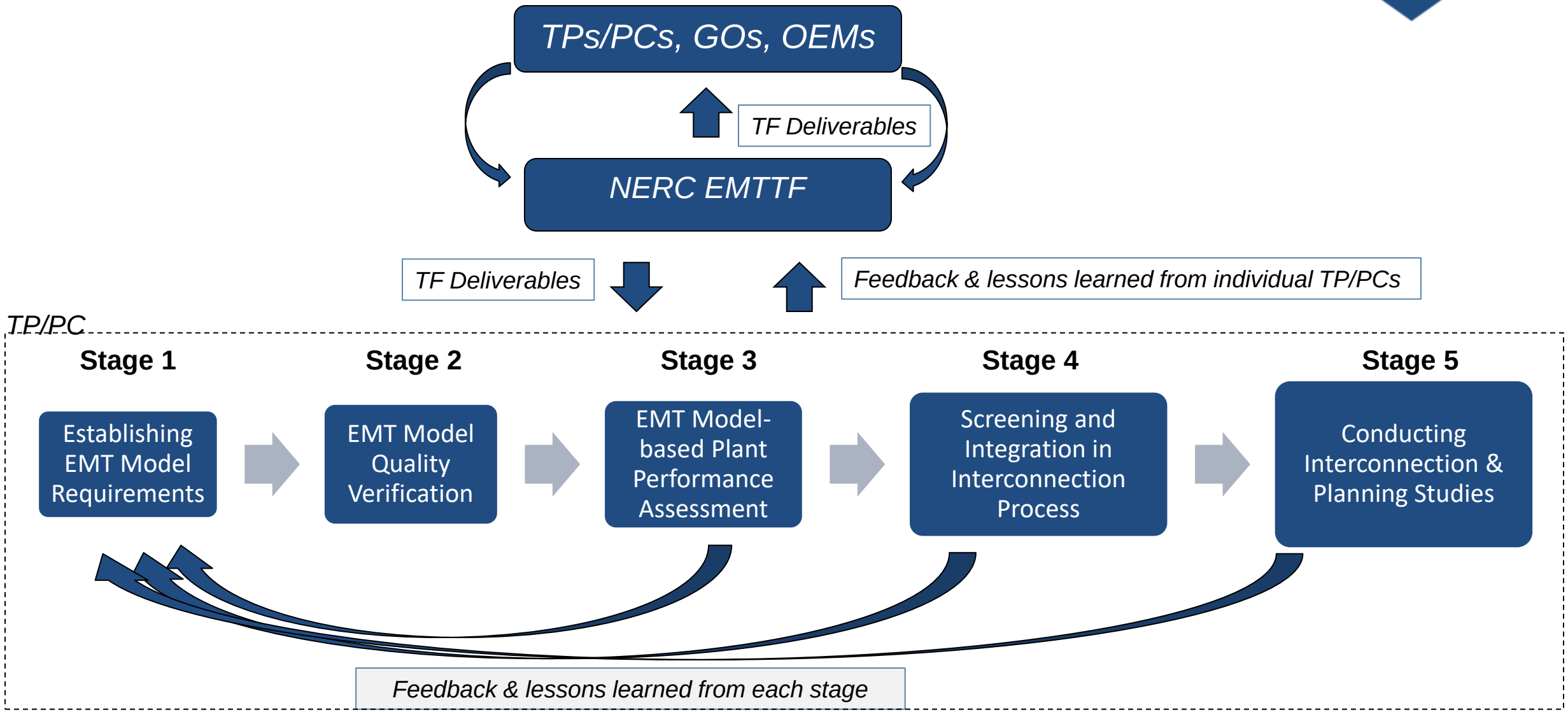
Resources to set Industry up for Success

Work Item #	Description
1	EMT Modeling Standard Monitoring and Support
2	**Reliability Guideline** – Recommended Practices for Performing EMT System Studies for Inverter-Based Resources
3	Organized Repo of Curated EMT Modeling Resources (“EMT Curriculum”)
4	**White Paper**: Case Study on Adoption of EMT Modeling and Studies in Interconnection and Planning Studies for BPS-connected IBRs
5	**White Paper**: EMT Analysis in Operations

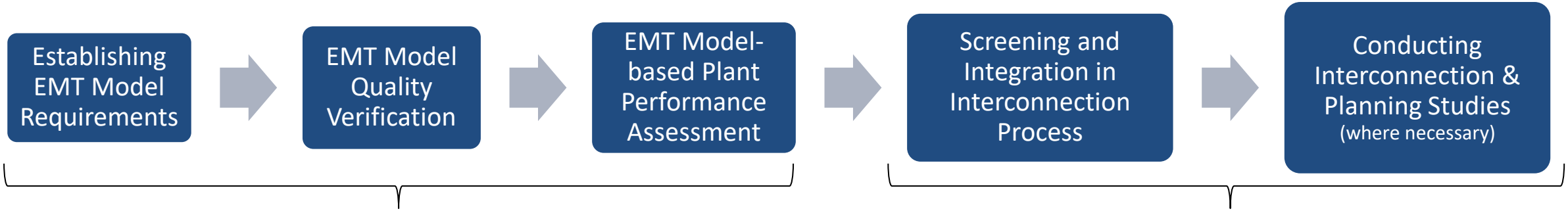
2024 Goals:

- Publish Reliability Guideline (#2) and White Papers (#4, #5)
- Go LIVE – Online EMT Repo (#3)

EMTTF Supporting EMT Adoption Across NA



EMT Reliability Guidelines

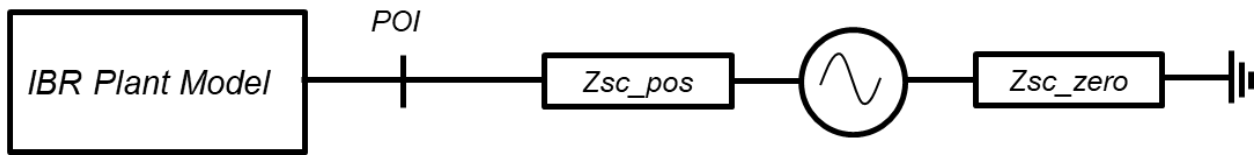


Reliability Guideline: EMT Modeling for BPS-connected IBRs: Recommended Model Requirements and Model Quality Verification
March 2023 ("Vol. 1")

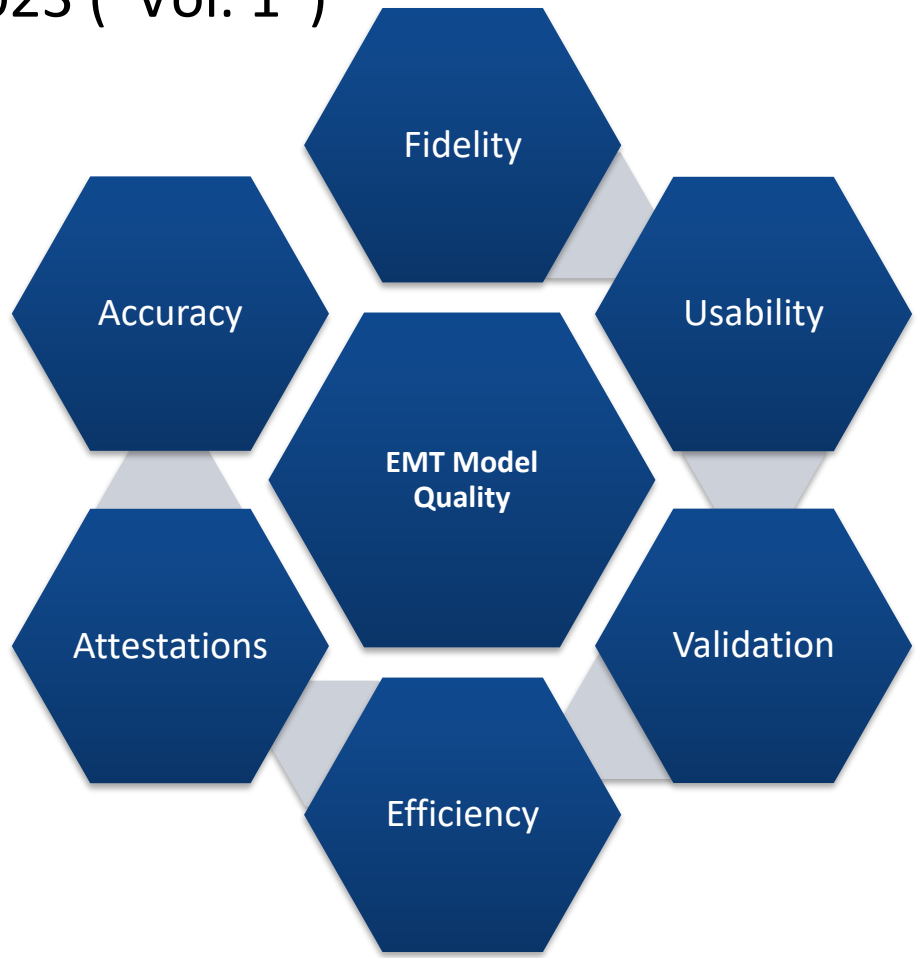
Draft Reliability Guideline: Recommended Practices for Performing EMT System Studies for IBRs ("Vol. 2")
(Targeting publication in December 2024)

EMT Guideline "Vol 1"

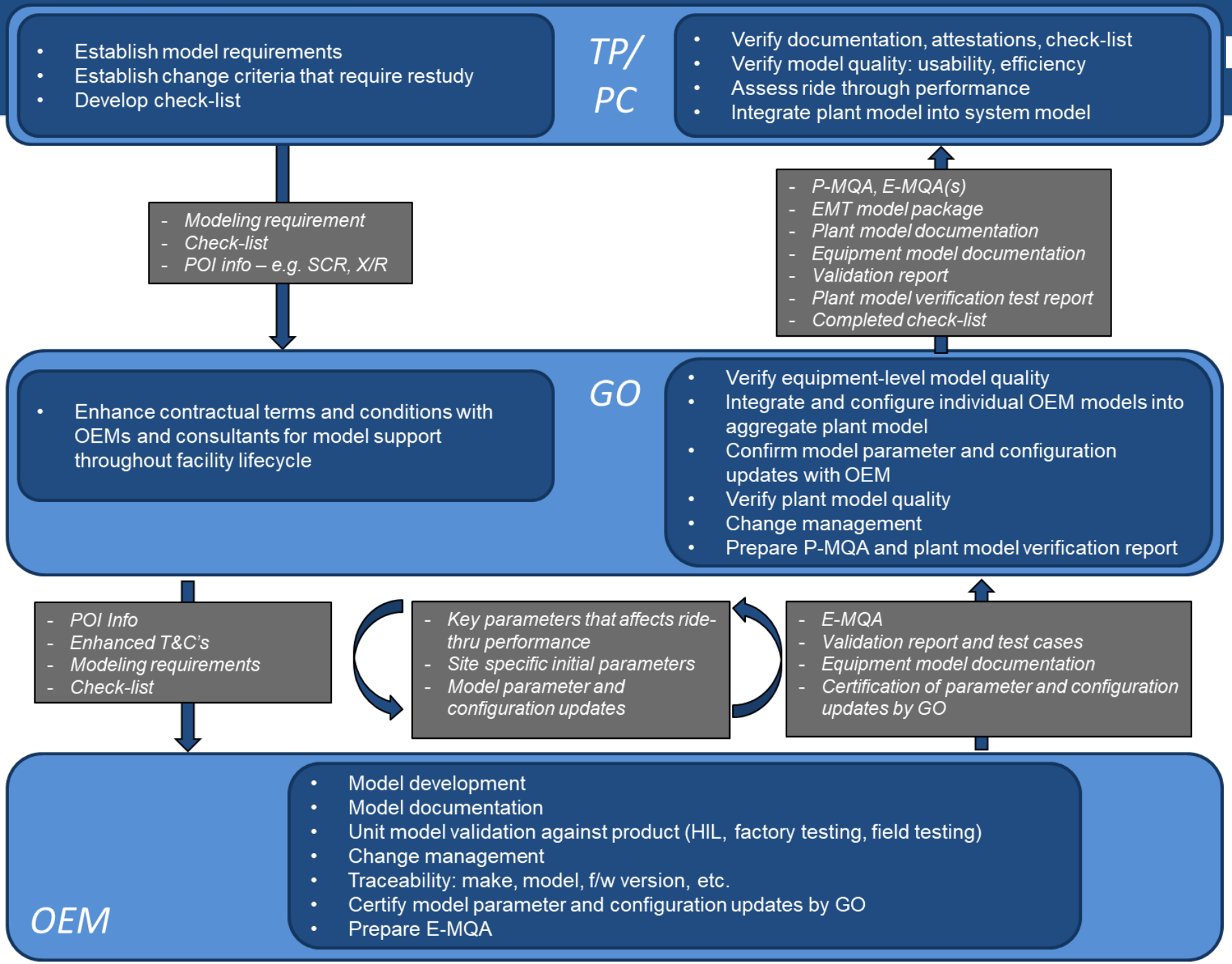
- Reliability Guideline: EMT Modeling for BPS-connected IBRs: Recommended Model Requirements and Model Quality Verification, March 2023 ("Vol. 1")
  - Model Quality, Verification and Attestations – E-MQA, P-MQA
  - Sample Model Checklist
  - Equipment-specific EMT Model Validation Reports
  - Benchmark Positive Sequence Dynamic Models
  - Model Verification Tests
    - **Model Adequacy Tests**: To verify usability, efficiency and accuracy requirements
    - **Functional Tests:** To verify model configuration and response
      - Follow command? Limit output? Limit ramp rate? PFR? AVR? Iq injection?
    - **Disturbance Ride-through Performance Tests**



Single Machine Infinite Bus Test Case

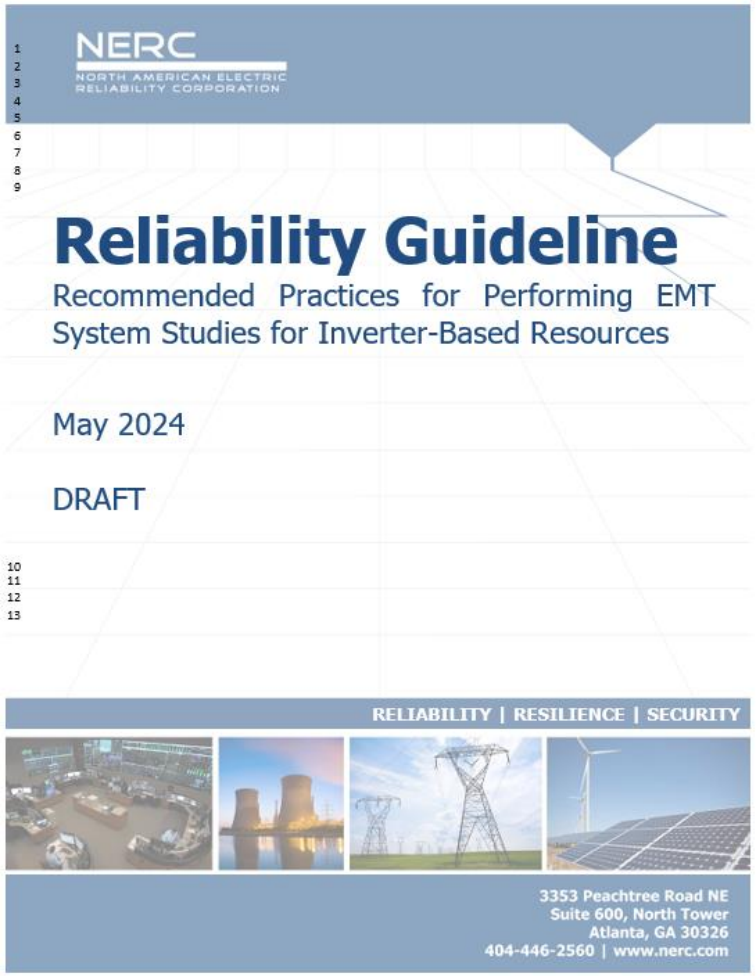


EMT Guideline "Vol 1"



Work Item 2 : EMT Guideline "Vol 2"

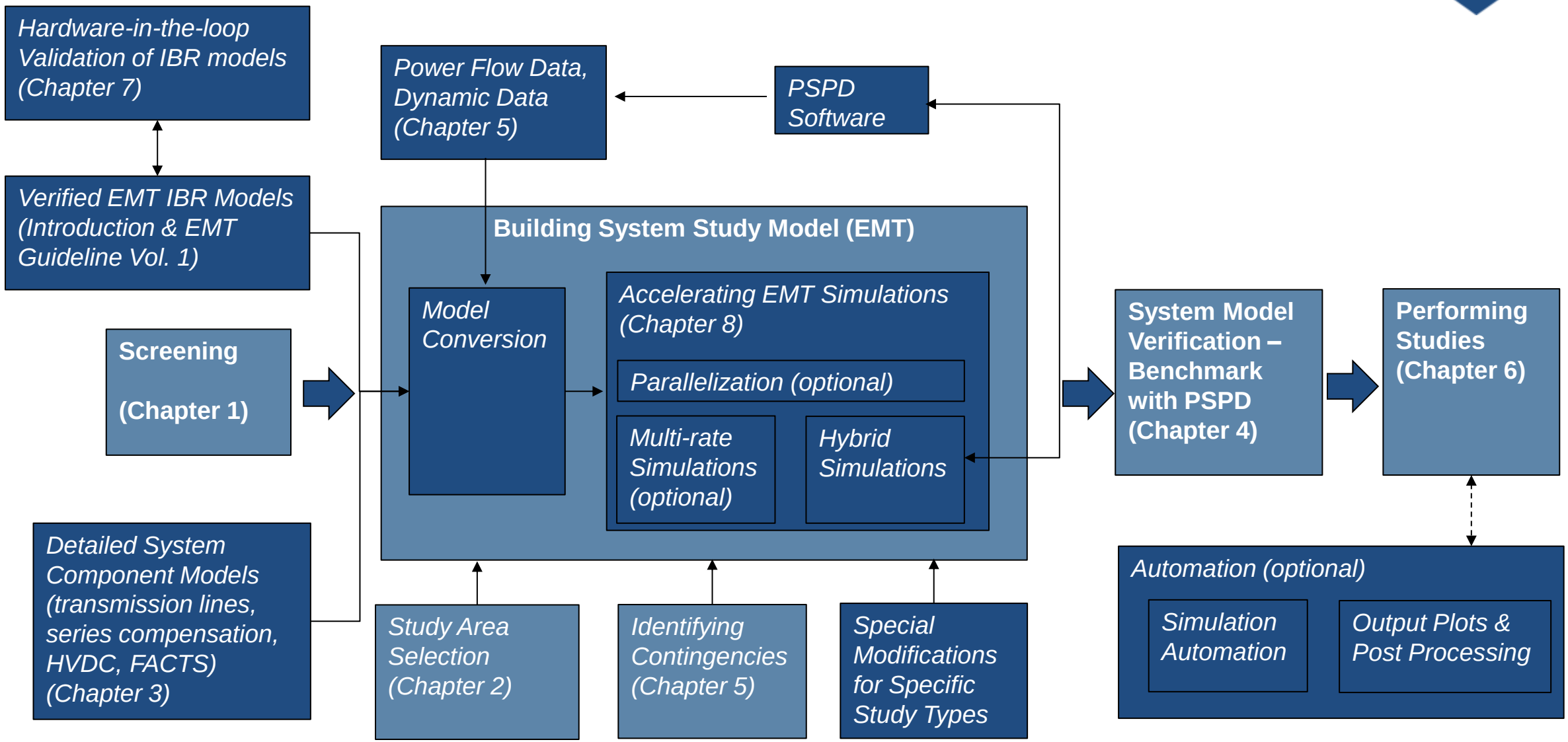
- **Reliability Guidelines – Recommended Practices for Performing EMT System Studies for Inverter-Based Resource**
  - **7** Chapters and **4** Appendixes
  - Out for 45-day industry review on July 1
  - Review period ends on August 15
  - Target publishing in December 2024



Purpose

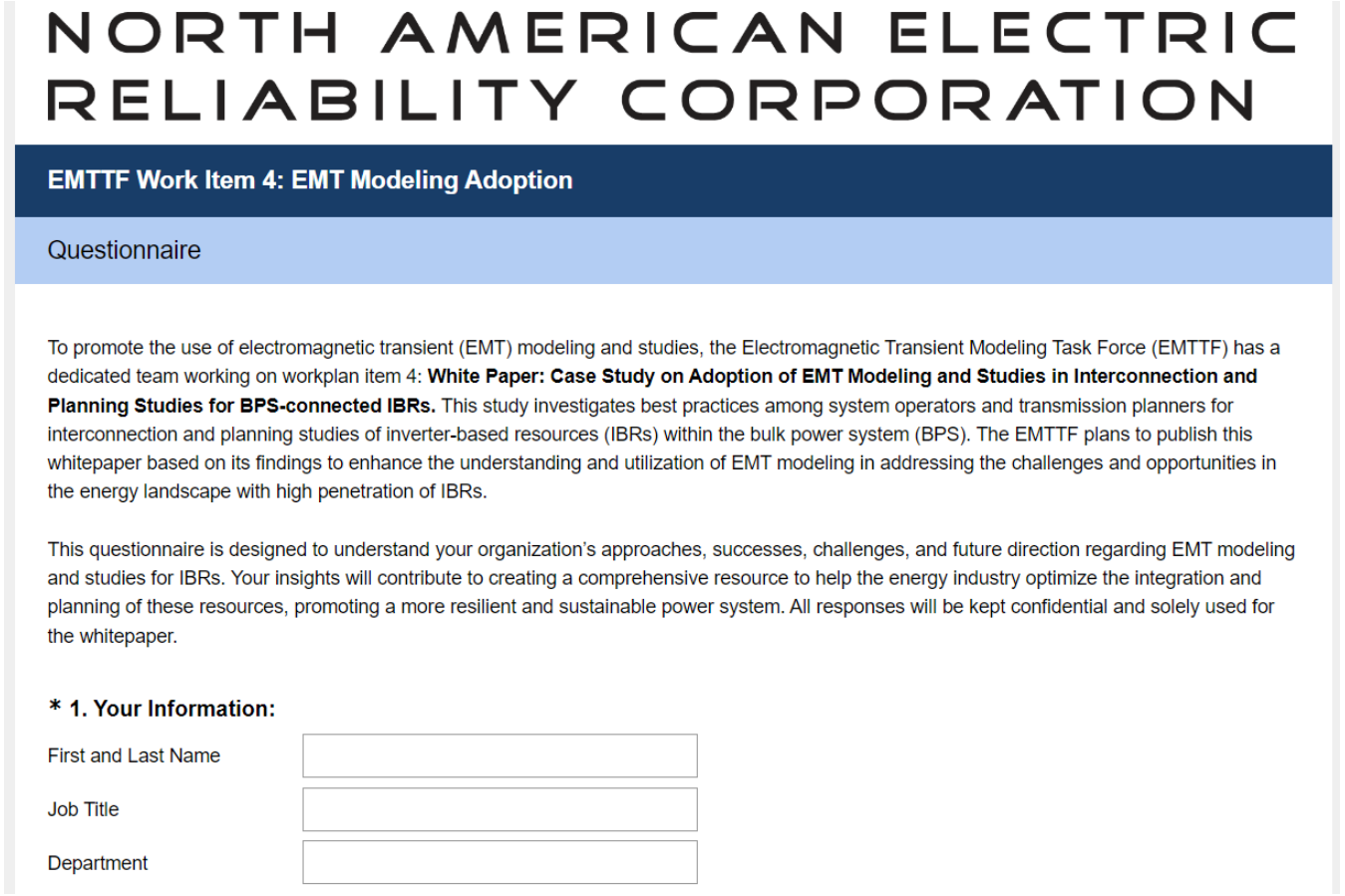
- For transmission planning **engineers to know when and how to study** the impact of IBRs on the BPS in EMT domain.
- The focus is **within the generator interconnection studies proc**ess, primarily system impact studies, and not conventional EMT studies such as insulation coordination, etc.

Work Item 2 : EMT Guideline "Vol 2"



Work Item 4 : EMT Modeling Adoption

- White Paper: Case Study on Adoption of EMT Modeling and Studies in Interconnection and Planning Studies for BPS-connected IBRs
  - **46** Questions
  - Posted on compliance bulletin
  - 40+ organization participated



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EMTTF Work Item 4: EMT Modeling Adoption

Questionnaire

To promote the use of electromagnetic transient (EMT) modeling and studies, the Electromagnetic Transient Modeling Task Force (EMTTF) has a dedicated team working on workplan item 4: **White Paper: Case Study on Adoption of EMT Modeling and Studies in Interconnection and Planning Studies for BPS-connected IBRs.** This study investigates best practices among system operators and transmission planners for interconnection and planning studies of inverter-based resources (IBRs) within the bulk power system (BPS). The EMTTF plans to publish this whitepaper based on its findings to enhance the understanding and utilization of EMT modeling in addressing the challenges and opportunities in the energy landscape with high penetration of IBRs.

This questionnaire is designed to understand your organization's approaches, successes, challenges, and future direction regarding EMT modeling and studies for IBRs. Your insights will contribute to creating a comprehensive resource to help the energy industry optimize the integration and planning of these resources, promoting a more resilient and sustainable power system. All responses will be kept confidential and solely used for the whitepaper.

*** 1. Your Information:**

First and Last Name

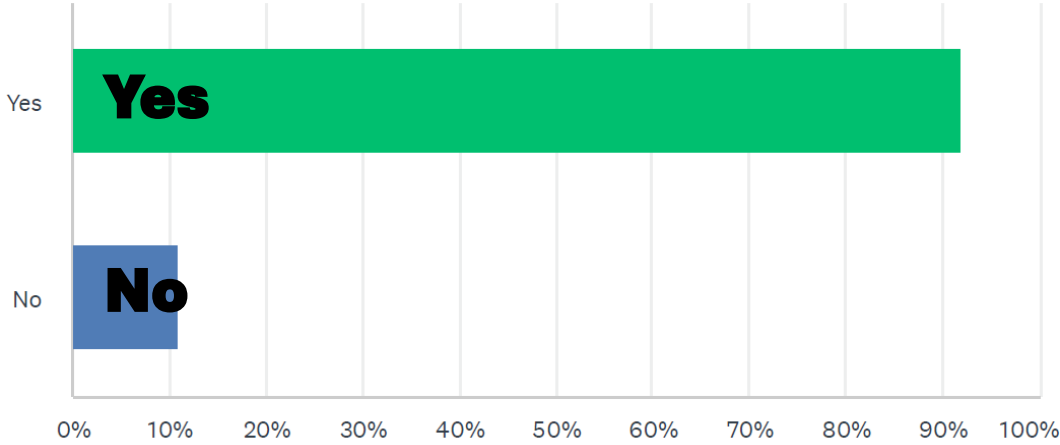
Job Title

Department

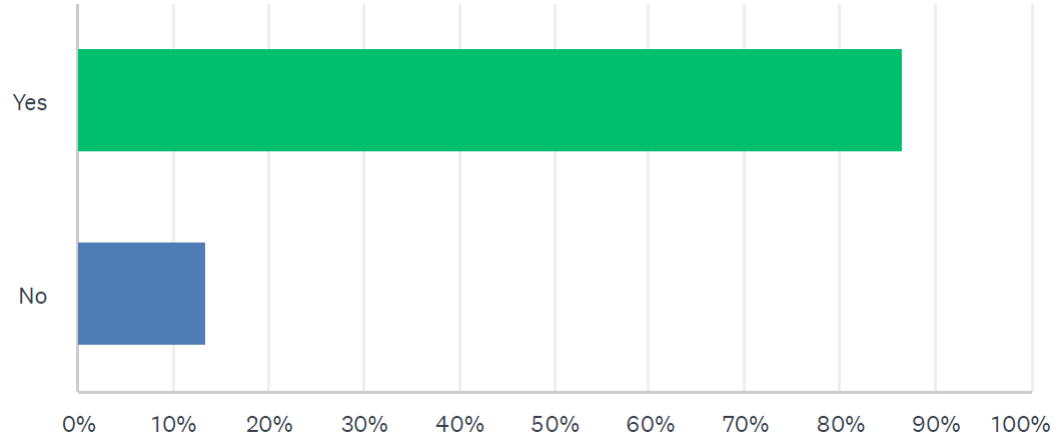
Work Item 4 : EMT Modeling Adoption

Survey Results (subset)

- Are you aware of NERC Reliability Guideline on EMT Modeling for BPS-connected IBR – Recommended Model Requirements and Verification Practices?



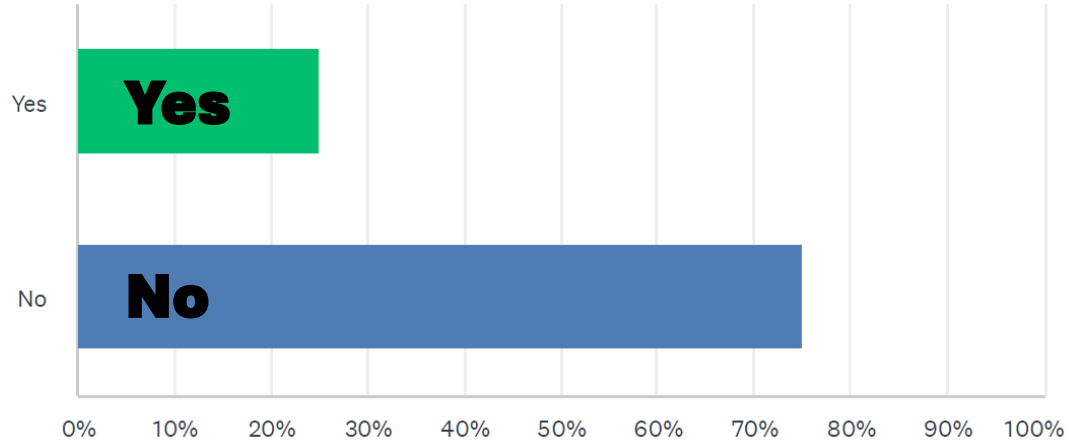
- Are you aware of NERC EMT Standard Authorization Request (SAR) that seeks to include EMT modeling in related standards such as TPL,MOD, and FAC?



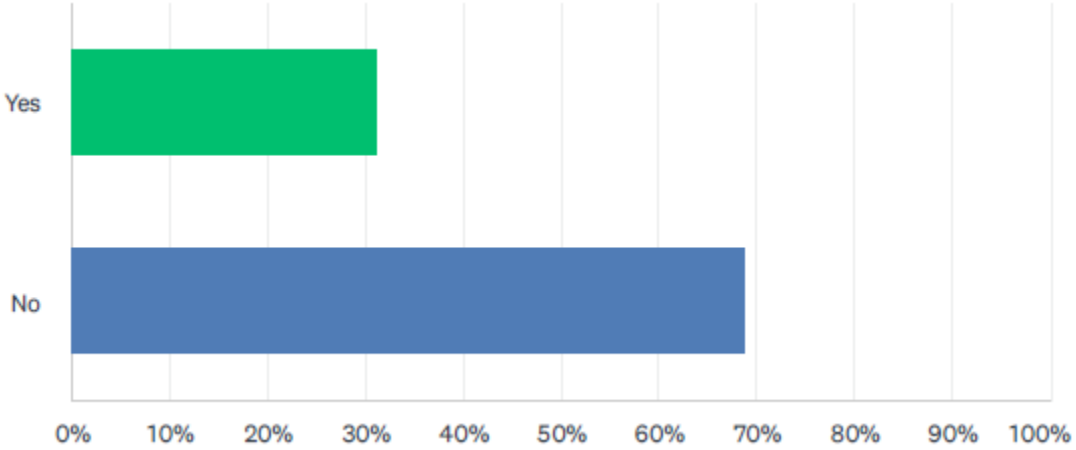
Work Item 4 : EMT Modeling Adoption

Survey Results

- Do you require submission of unit model validation report which compares EMT model to either lab or HIL test of actual inverter unit?



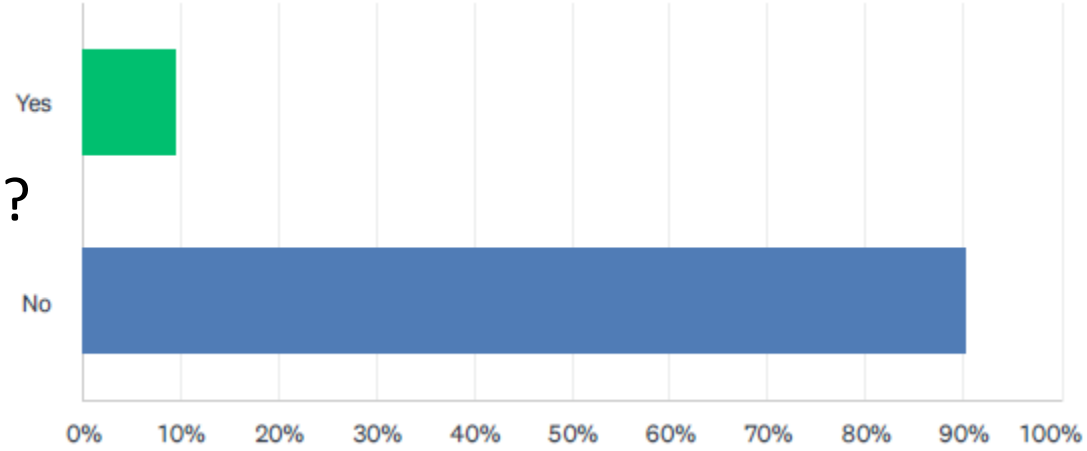
- Do you plan to develop EMT model for the entire system within your organization footprint?



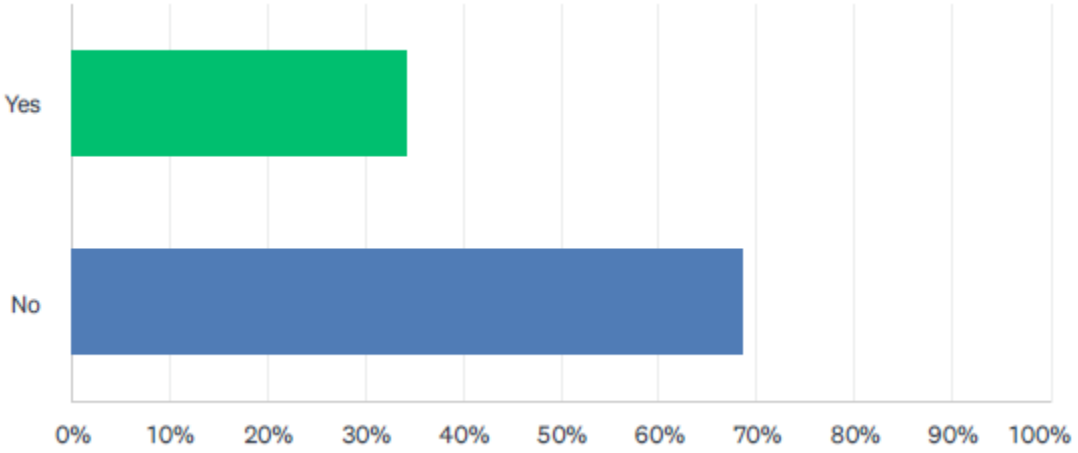
Work Item 4 : EMT Modeling Adoption

Survey Results

- Are you running EMT Transient hybrid simulation (co-simulation between EMT and Phasor software)?



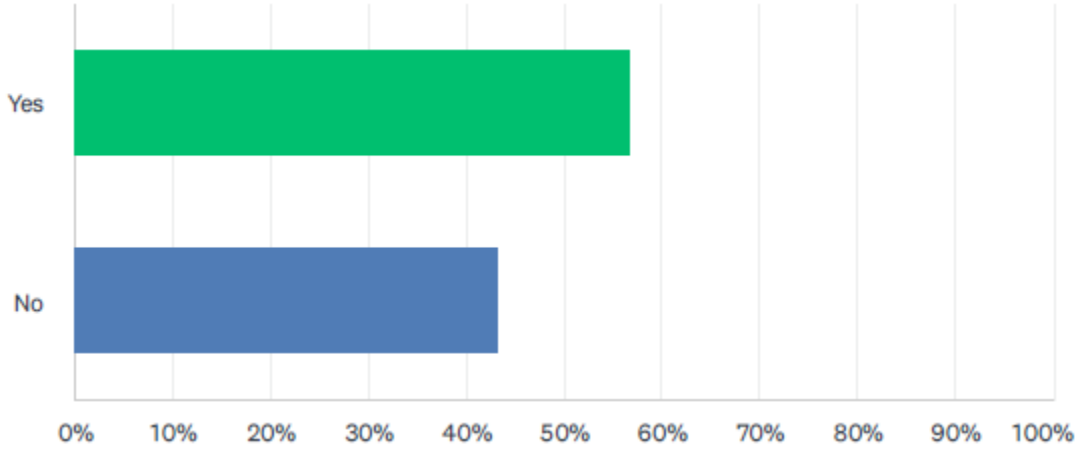
- Do you replicate system events using EMT models for validation purposes?



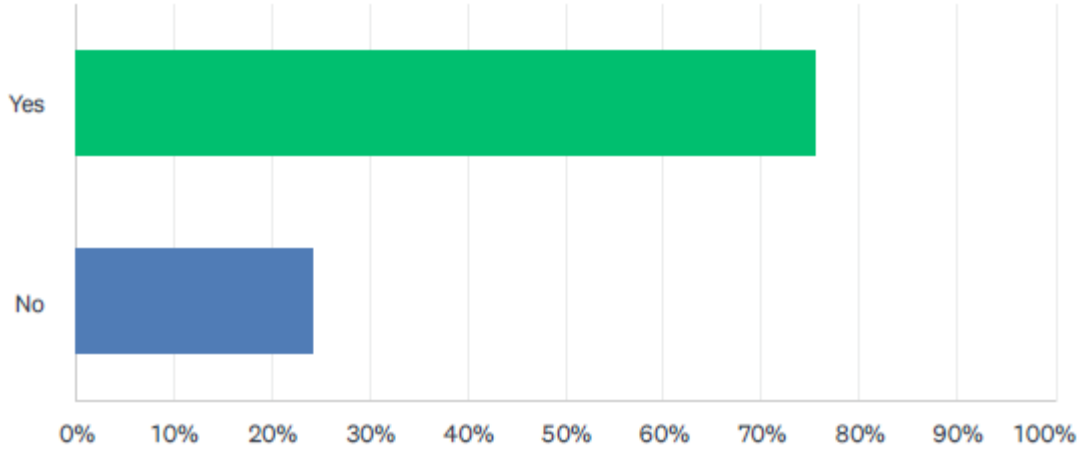
Work Item 4 : EMT Modeling Adoption

Survey Results

- Do you require GOs/GOPs to report when changes happen in the field, such as firmware upgrades to the controllers and hardware updates?

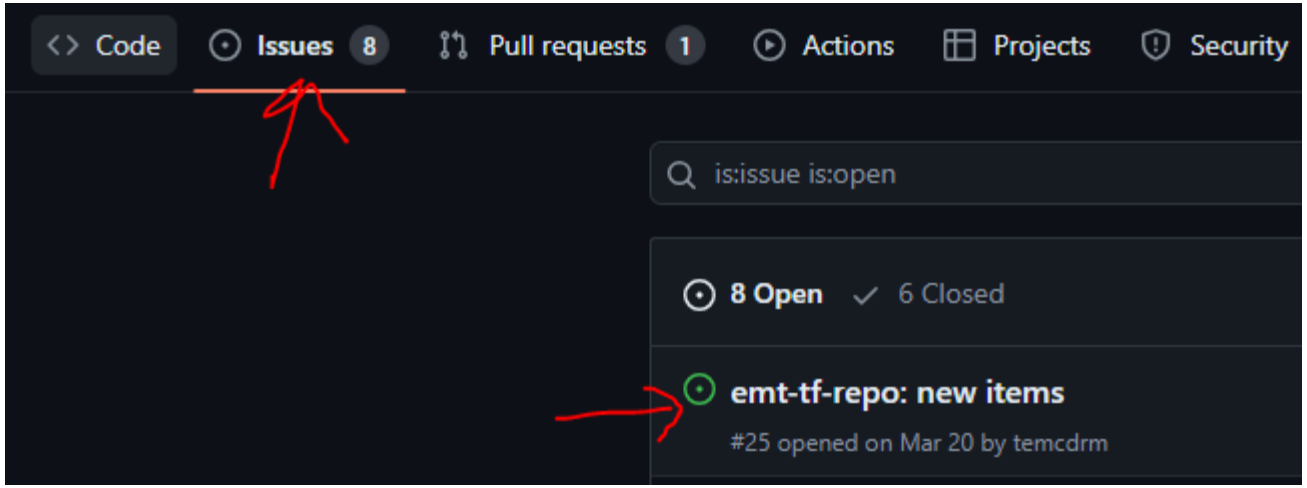


- Do you leverage or plan to rely on parallel processing for improved study efficiency?



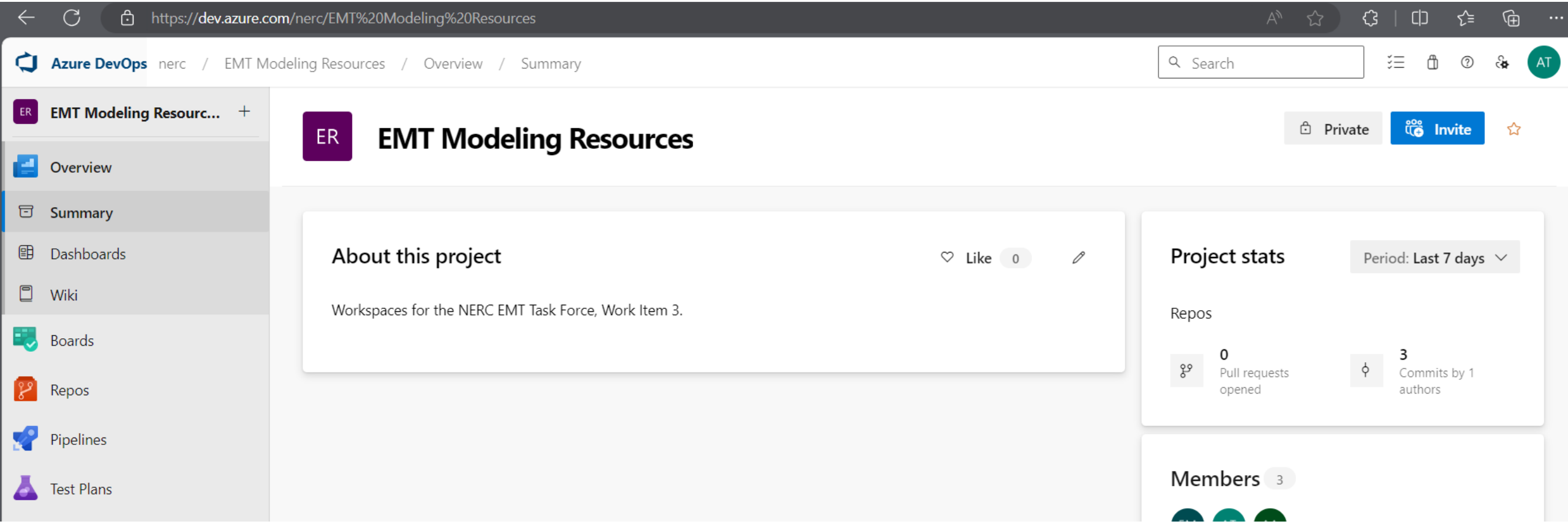
Work Item 3 : EMT Repo

- Organized Repository of Curated EMT Modeling Resources (“EMT Curriculum”)
  - *Temporary* location: https://github.com/pnnl/i2x/tree/develop/emt-tf-repo
  - Open to public
  - Issue reporting and tracking for the published items (e.g. this model has an issue under “X” conditions)
  - Public can request/suggest new items (new reference material, models, scripts, etc.)
  - Change management



Work Item 3 : EMT Repo

- Organized Repository of Curated EMT Modeling Resources ("EMT Curriculum")
  - *Permanent* location: Under construction on Azure DevOps platform

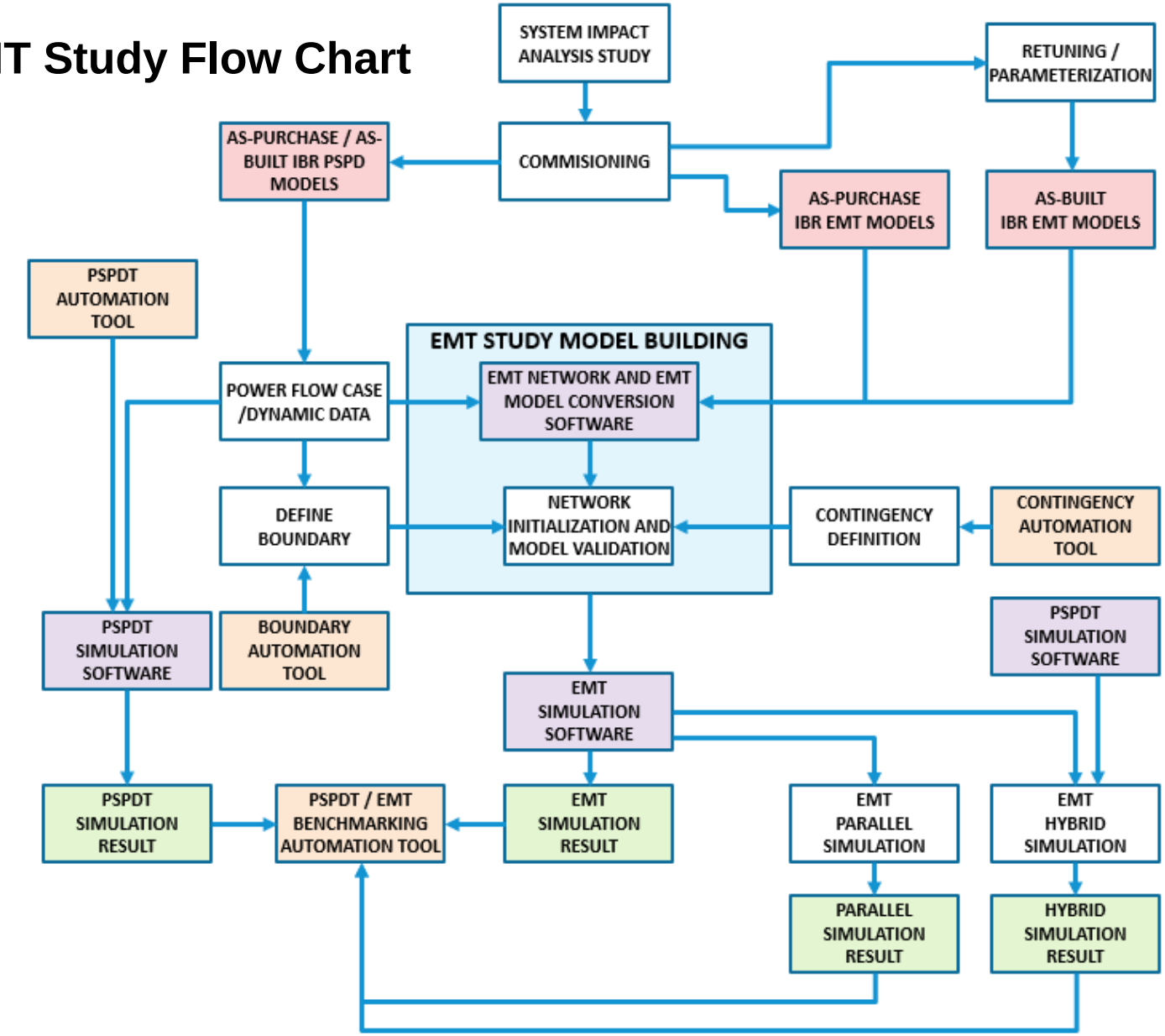


Work Item 3 : EMT Repo

- Organized Repository of Curated EMT Modeling Resources (“EMT Curriculum”)
  - *New Item*: EMT Model Portability white paper
  - Everyone is invited to review and provide feedback
  - Next revision: incorporate IEEE/Cigre “Power System DLL Models/Standard” into CIM

Work Item 5 : EMT Analysis in Operations

Operations EMT Study Flow Chart



Looking Ahead to 2025

- EMT modeling and requirements for IBR-related reliability studies continues to evolve
  - Revision to EMT Modeling Guideline (2023) is needed and should be a living document
  - Need to equip vendors, developers up to date guidance to meet the requirements

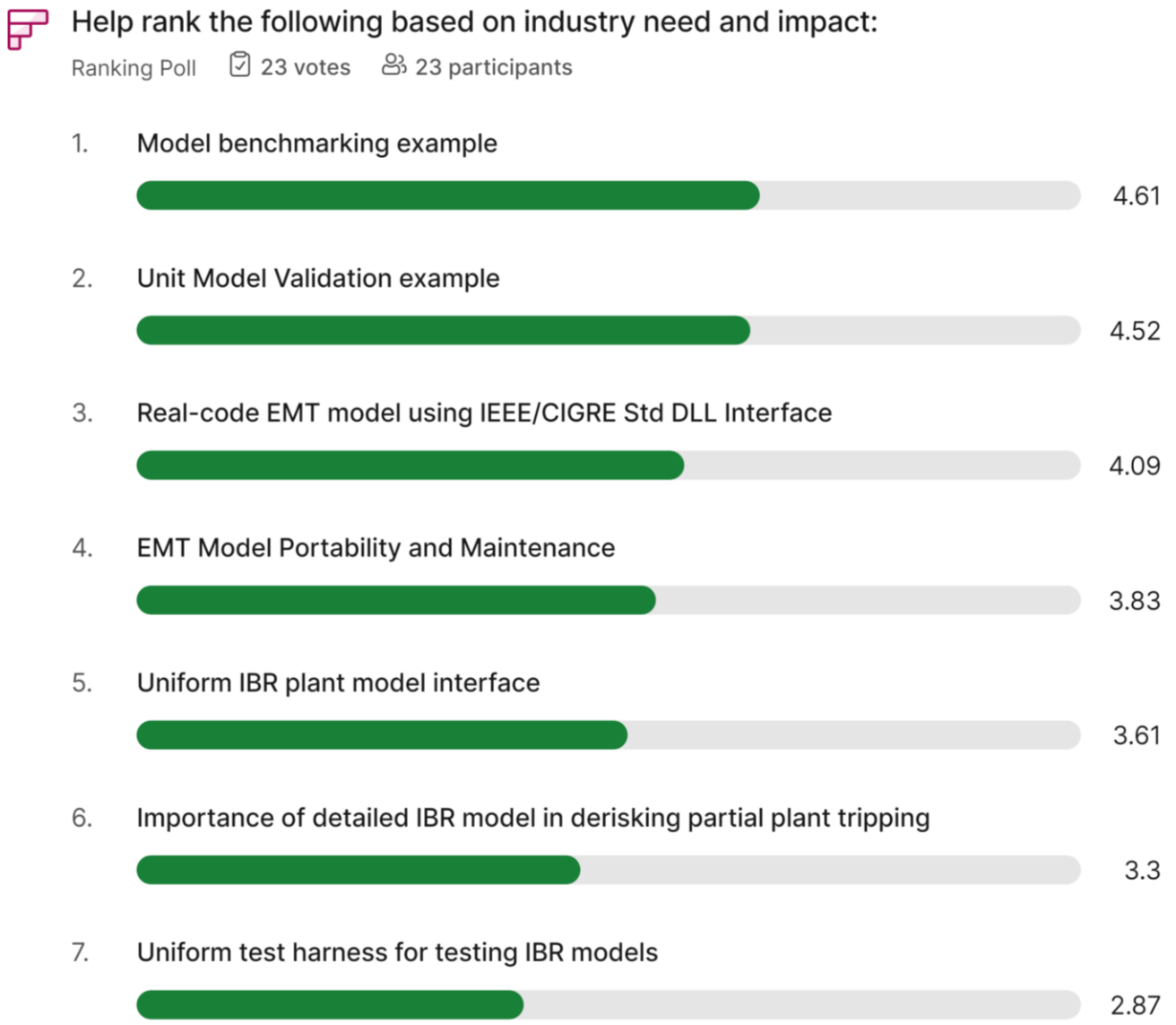
- Continue to drive harmonization/consistency across the industry, thus, increasing the efficiency for the vendors and developers
  - IEEE/CIGRE DLL Standard
  - Model portability
  - General training
  - Better support by software vendor - common test harnesses (with maximum flexibility and adaptability)

Looking Ahead to 2025

- As industry experience grows, the lessons learned need to be captured and shared broadly.
- As EMT adoption grows, we can expect more strain on the already constrained resources.
- Continue to support Project 2022-04 EMT Modeling
- May evolve into a working group (EMTWG?)

Looking Ahead to 2025

- Poll during September meeting
- Over 50 attended the meeting
- 23 participated in the poll



Get Involved!

- Meets monthly on every 4th Tuesday between 11 – 12:30 pm Pacific
- Sub-groups meet more frequently to work on work items
- Website
  - https://www.nerc.com/comm/RSTC/Pages/EMTTF.aspx

Questions and Answers

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