NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

EMTTF

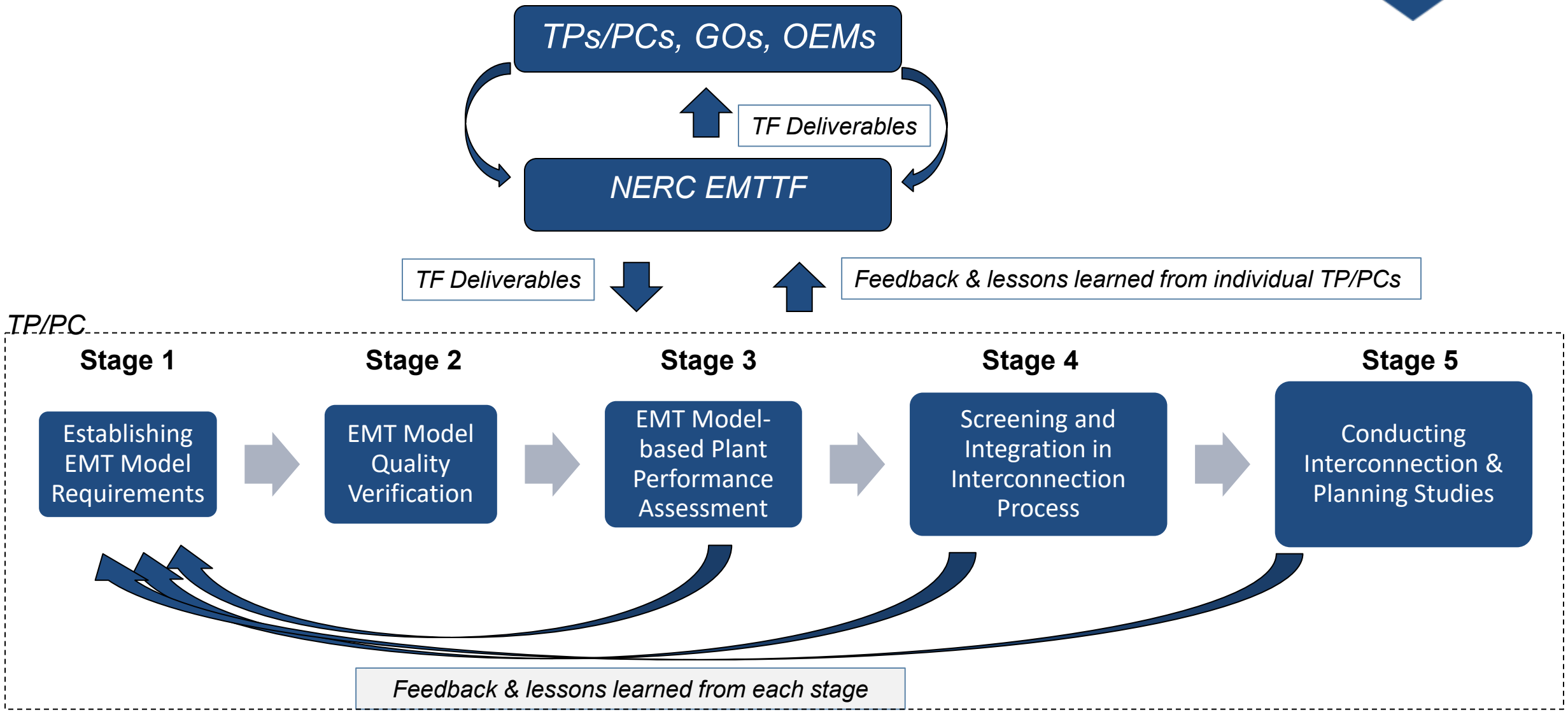
Supporting Widespread Adoption of EMT Modeling

Aung Thant, Senior Engineer, EMTTF Coordinator
EMT Workshop @ ORNL
August 13, 2024

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

EMTTF Supporting EMT Adoption Across NA

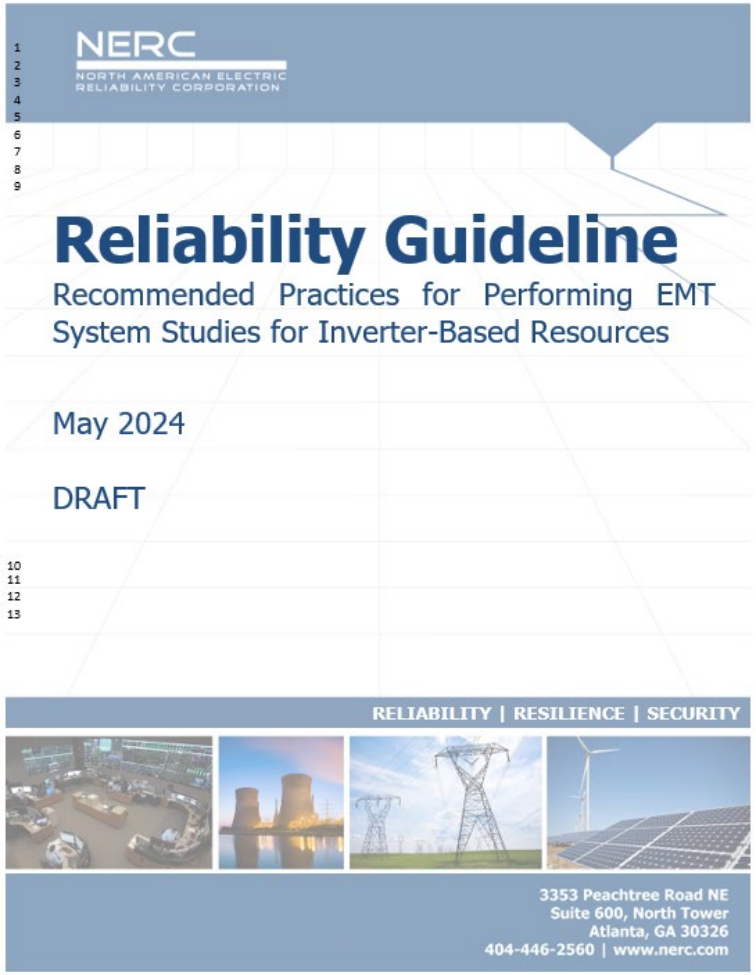


Work Items – Resources to set Industry up for Success

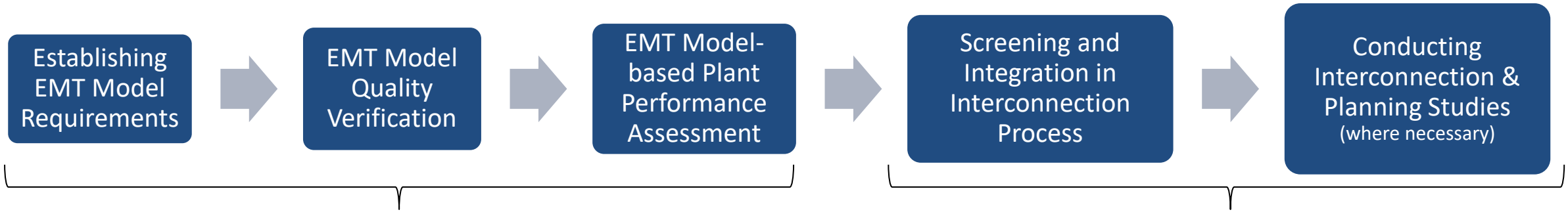
- Reliability Guidelines – Recommended Practices for Performing EMT System Studies for Inverter-Based Resources
  - Out for 45-day industry review on July 1
  - Review period ends on August 15
  - Target publishing in December 2024

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.



EMT Reliability Guidelines

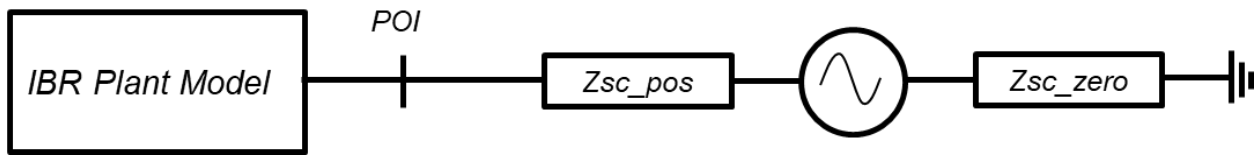


Reliability Guideline: EMT Modeling for BPS-connected IBRs: Recommended Model Requirements and Model Quality Verification
March 2023 ("Vol. 1")

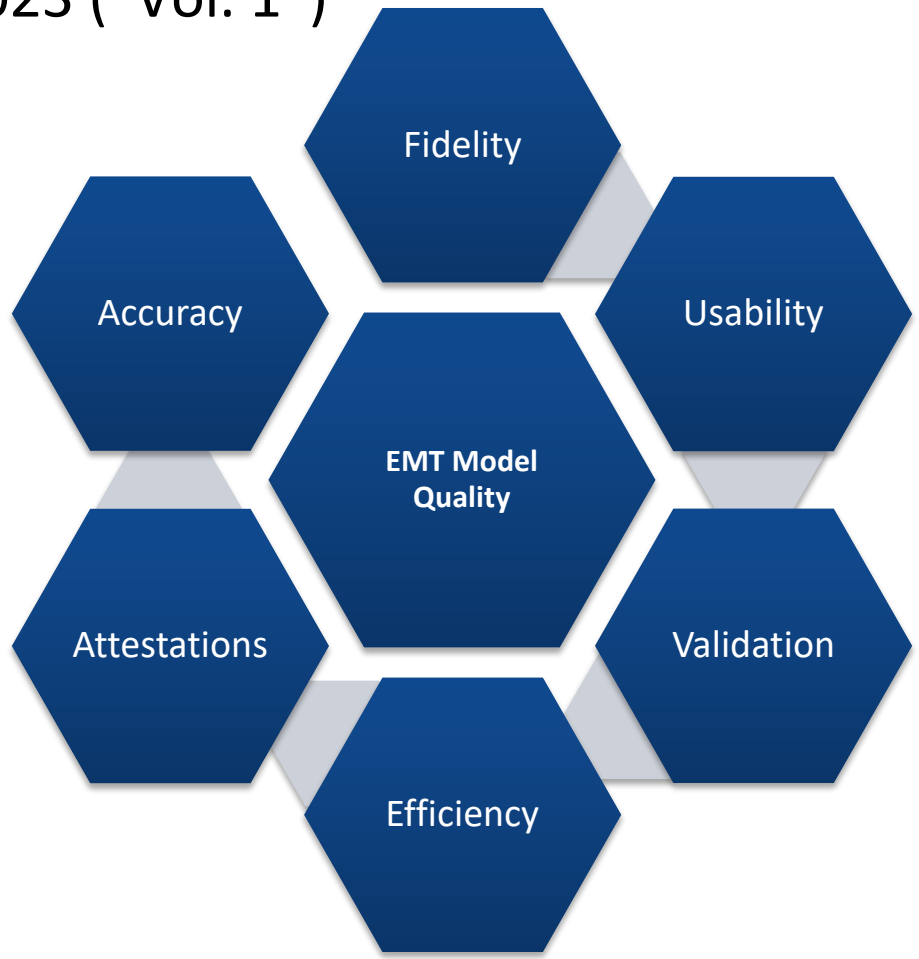
Draft Reliability Guideline: Recommended Practices for Performing EMT System Studies for IBRs ("Vol. 2")
(Targeting publication in December 2024)

EMT Guideline "Vol 1"

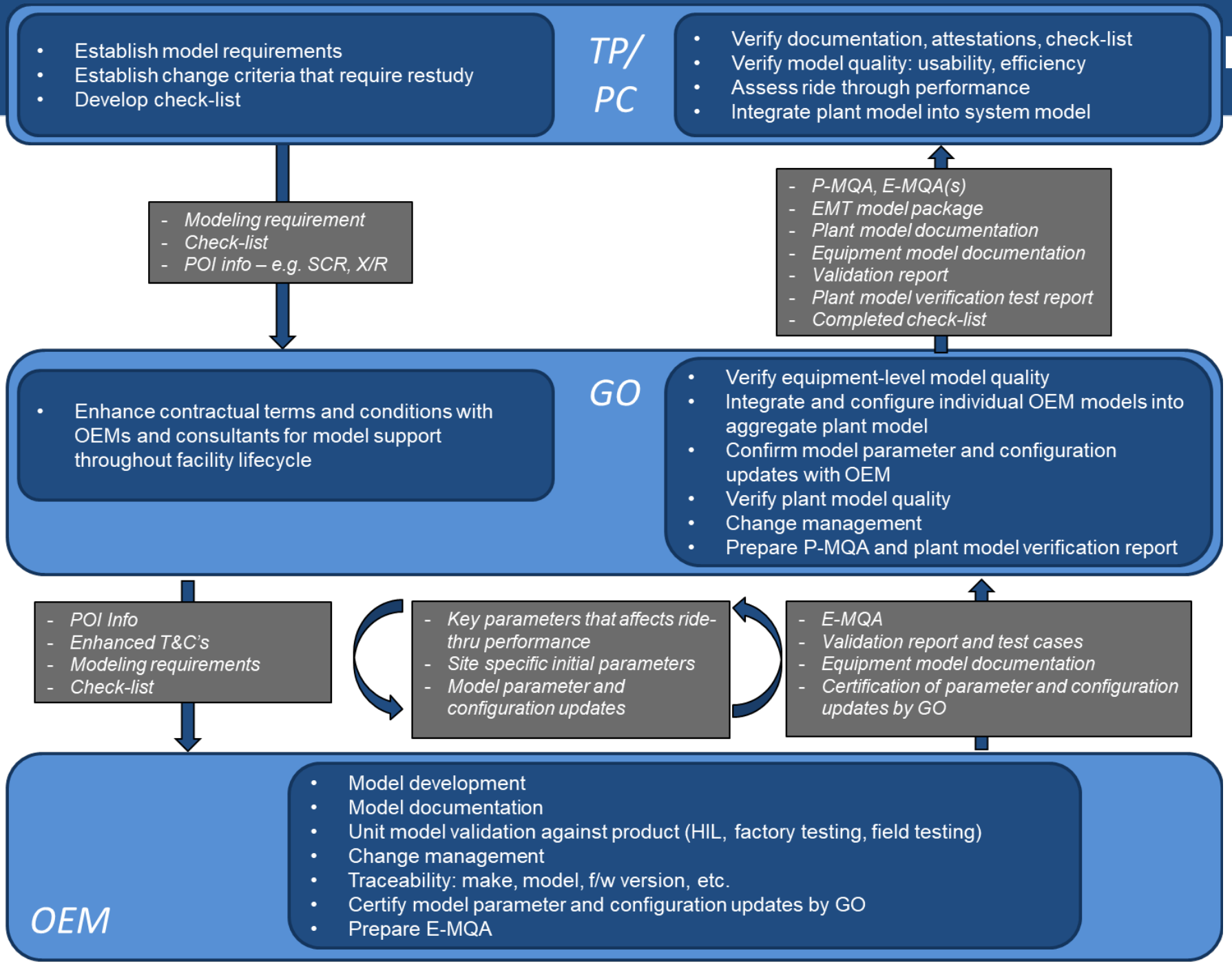
- Reliability Guideline: EMT Modeling for BPS-connected IBRs: Recommended Model Requirements and Model Quality Verification, March 2023 ("Vol. 1")
  - Model Quality, Verification and Attestations – E-MQA, P-MQA
  - Sample Model Checklist
  - Equipment-specific EMT Model Validation Reports
  - Benchmark 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"

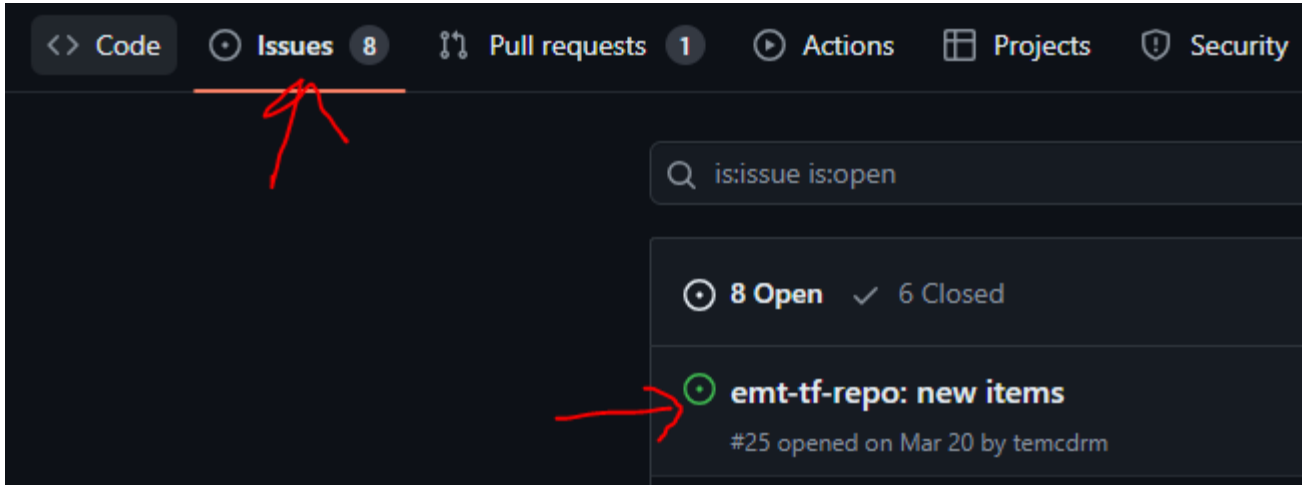


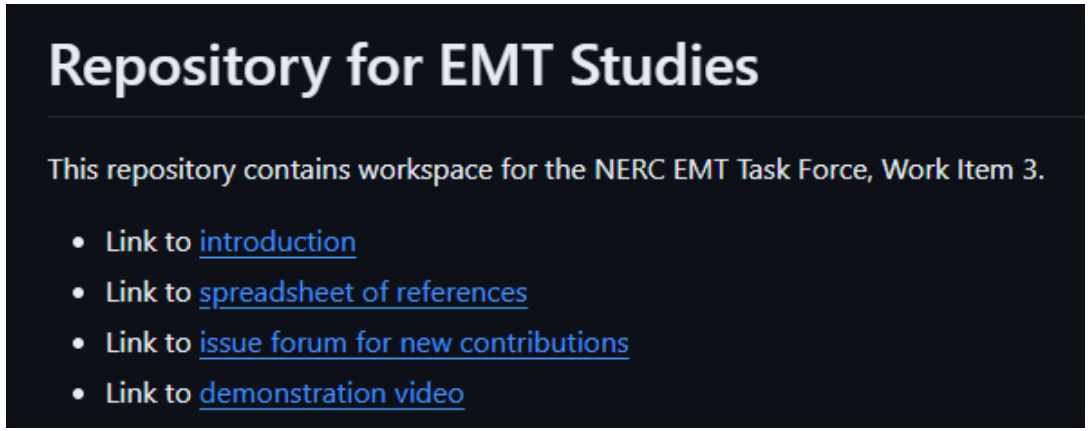
EMT Guideline "Vol 2"

- Reliability Guideline: EMT Modeling for BPS-connected IBRs: Recommended Practices for Performing EMT System Studies for IBRs ("Vol. 2")
- Chapter 1: When to Perform EMT Studies
- Chapter 2: How to Select Study Area to Be Modeled
- Chapter 3: How to Model Study Area and Surrounding External System
- Chapter 4: System Base Case Model Validation
  - System Model Validation – power flow, fault current, dynamic response, field events
- Chapter 5: Study Scenarios
  - most critical contingencies and the worst-case operating conditions in which less grid stabilizing characteristics are available, such as system strength, inertia, and damping
- Chapter 6: Dynamic System Impact Assessment Study

Work Items – Resources to set Industry up for Success

- 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 Items – Resources to set Industry up for Success

- White Paper: Case Study on Adoption of EMT Modeling and Studies in Interconnection and Planning Studies for BPS-connected IBRs
  - Target group: Transmission Planners (TPs) and Planning Coordinators (PCs)
  - Survey sent on June 6, closed on July 30
  - https://www.surveymonkey.com/r/NMQ956Z
  - Posted on compliance bulletin
  - Received response from 40+ organization
  - Drafting already underway

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

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 Items – Resources to set Industry up for Success

- White Paper: EMT Analysis in Operations
  - On-going
  - Calling for more operators to get involved

  - Why EMT analysis in operations space?
  - What are necessary processes for successful EMT analysis pipeline?
  - Why are they so important?
  - What are the challenges for EMT analysis in operations time horizon?

Work Items – Resources to set Industry up for Success

- White Paper: EMT Analysis in Operations
  - Offline studies for identifying
    - Operating Limits
    - Generations limitations
    - Interface limitations
    - Facility out limitations
    - Adverse interactions with other dynamic resources or other IBRs
    - Developing the operating guidance that defines more conservative performance

NERC EMTTF

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

NERC EMT Resources

- EMTTF EMT Repo

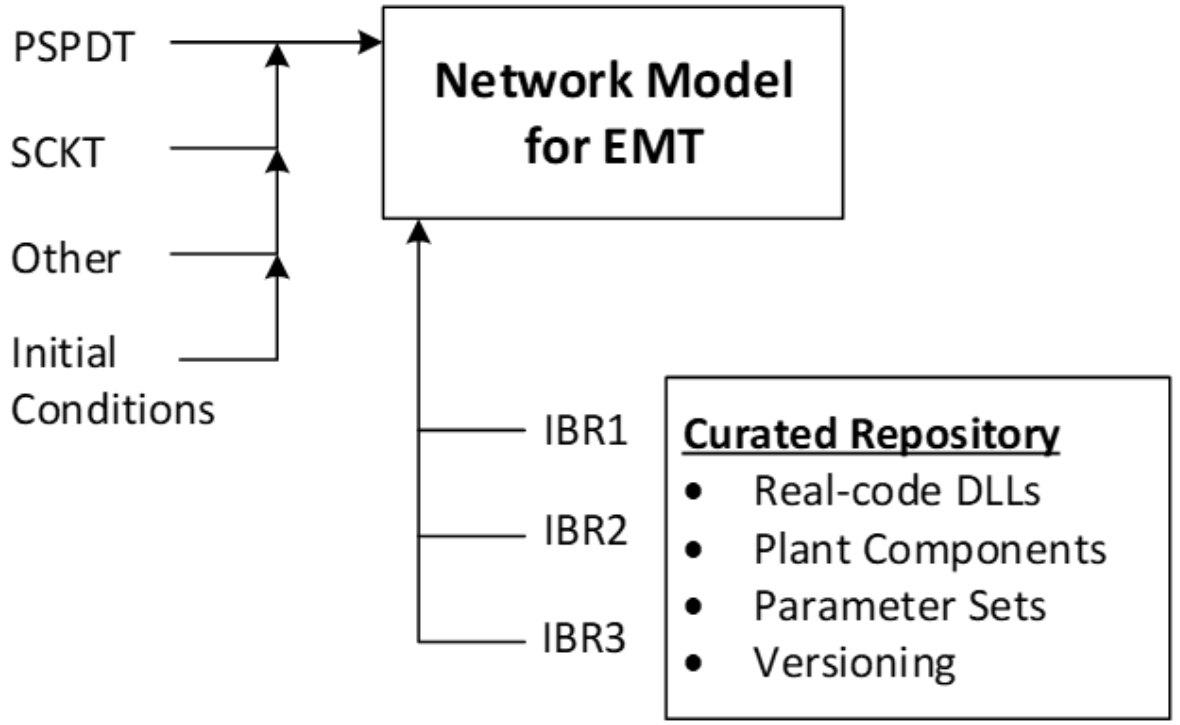
https://github.com/pnnl/i2x/tree/develop/emt-tf-repo (temporary location)

- EMT Boot Camp materials (NERC-PNNL collaboration)

https://github.com/pnnl/i2x/tree/develop/emt-bootcamp

Model Management

- Complete IBR model life cycle management process
  - As-studied model evolution into an as-built model, changes tracked and validated
  - Repository containing accurate, vetted, ready-to-use EMT models
  - Change management
  - Documentation and long-term maintenance
- Mature study and simulation pipeline
  - Conveying initial steady-state conditions and disturbance info
  - Executing simulations in an efficient manner
  - Extracting meaningful results



Example Model Repo Attributes
(excerpt from Draft Whitepaper: EMT Analysis in Operation)

Thought of the Day

> “ Start with the customer experience and work backward toward the technology ”
>
> - Steve Jobs

Questions and Answers

Contact:
Aung.Thant@nerc.net