Interconnection Study Process

Reliability Implications and Improvements

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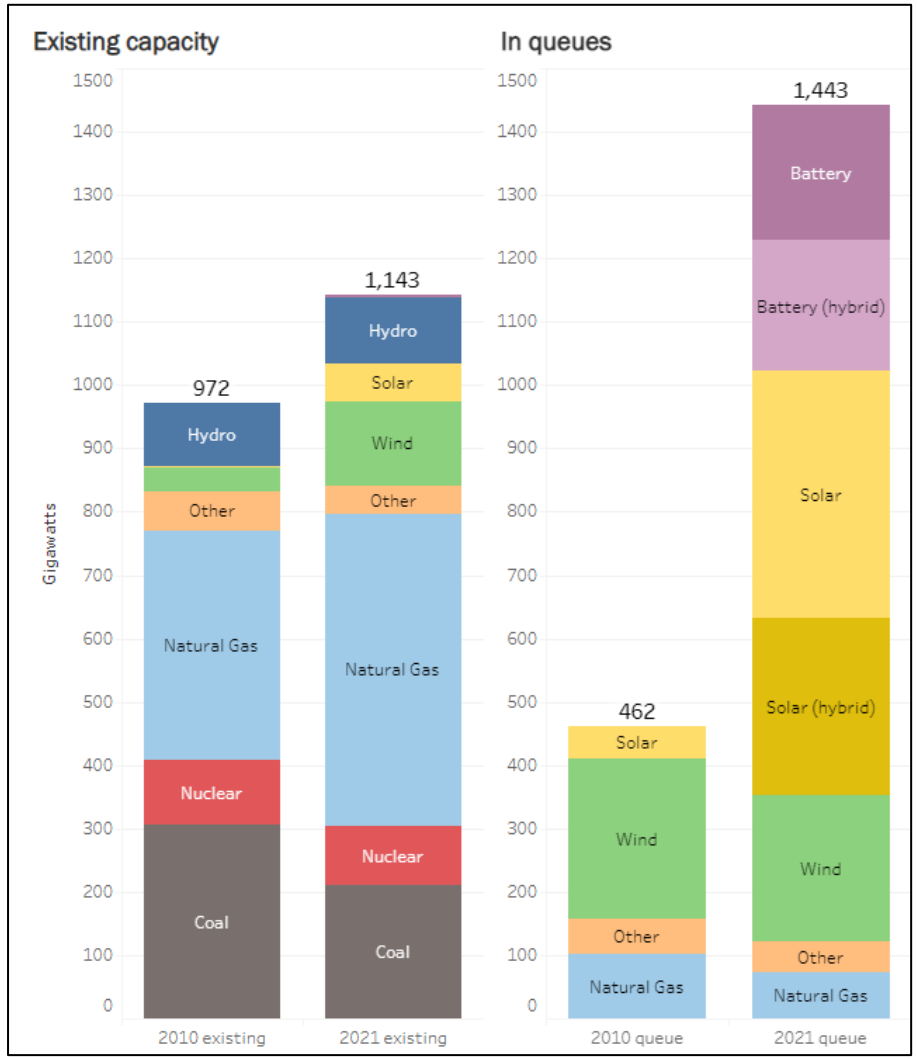
10/25/2022

Joint Workshop on Interconnection

ESIG | NAGF | NERC | EPRI

August 9 – 11, 2022



https://emp.lbl.gov/generation-storage-and-hybrid-capacity

179 FERC ¶ 61,194
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

[Docket No. RM22-14-000]

Improvements to Generator Interconnection Procedures and Agreements

(June 16, 2022)

IEEE Std 2800™-2022

IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems

Developed by the

Energy Development & Power Generation Committee, Electric Machinery Committee, and Power System Relaying & Control Committee
of the
IEEE Power and Energy Society

Approved 9 February 2022

IEEE SA Standards Board

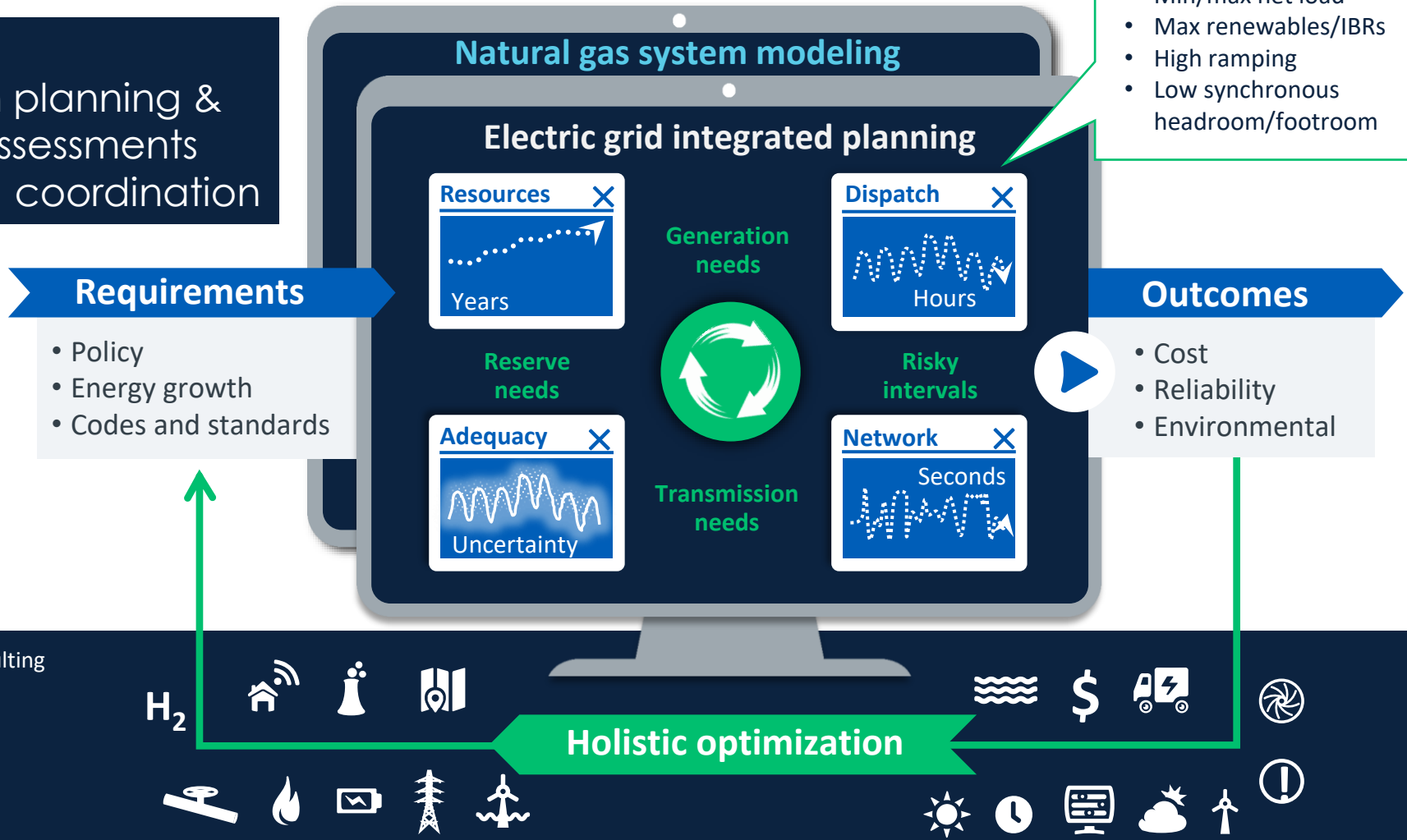
INTERCONNECTION INNOVATION e-XCHANGE
U.S. DEPARTMENT OF ENERGY

an EERE collaboration between SETO & WETO

JOINT WORKSHOP LINK

Need for integrated and holistic planning & interconnection

NEED: Transmission planning & interconnection assessments overlap and need coordination



ID new periods of risk:

- Min/max net load
- Max renewables/IBRs
- High ramping
- Low synchronous headroom/footroom

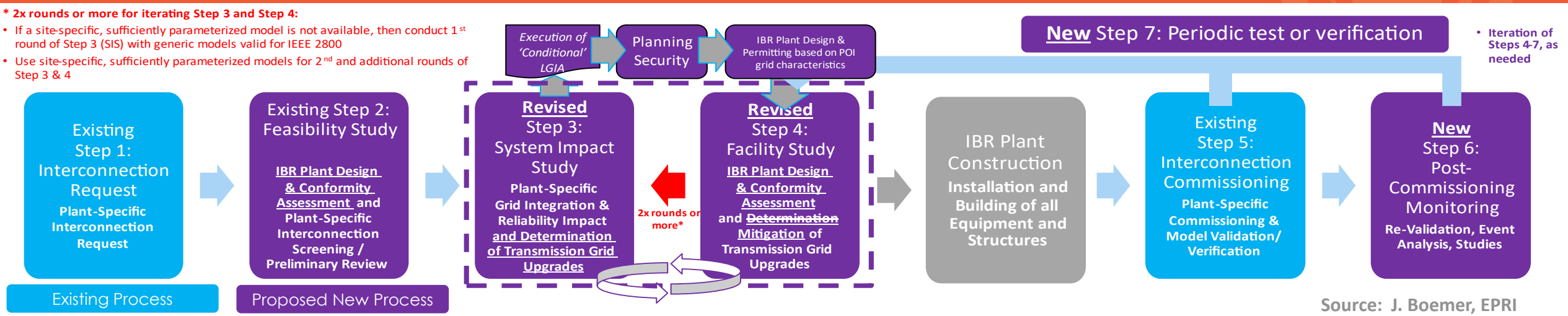
Source: S. Manz, GE Energy Consulting

Further need for reform

Seven recent NERC disturbance event reports identify need for:

- More detailed, clear, **harmonized interconnection requirements**
- Better **alignment of interconnection studies** with project development timelines
- **Accurate modeling:** models that reflect equipment and settings in the field and match actual equipment behavior. Present pos. seq. and EMT models did not capture some causes of inverter tripping during disturbance events.
- Models need to include **controls, modes of operation, settings, and protections** that could affect ability to ride through and provide essential reliability services
- Use of **correct models to study specific phenomena** (need for steady state, phasor-domain and EMT models)

Possible interconnection studies and process improvements



Source: J. Boemer, EPRI

INTERCONNECTION STUDIES

- Project development is long – need for **accurate models sooner in the process** and tollgates to update along the way.
- Better **coordination between grid operator and developer** on requirements & permitting to reduce cycle time.
- Stability impacts should be studied in **clusters of IBRs** (vs. one project at a time) to assess full risk of interaction across projects and regions. Need **tollgates for mitigation**.
- IBR **control parameter tuning** should be considered a viable alternative to transmission upgrades (when relevant).

MODELING

- **All models have limitations.** Generic not necessarily bad or EMT more accurate. Identifying proper models & tools is key.
- **Control-loops and protective functions** relevant for a studied phenomenon should be included in the model
- **Strong need for validated pos. seq. and EMT models**
  - Limited field validation during commissioning
  - Unit type-testing & careful plant design evaluation
  - Post-commissioning disturbance monitoring to validate for large signal disturbances

Updates to NERC Modeling & Studies Standards
EMT studies and models will be required

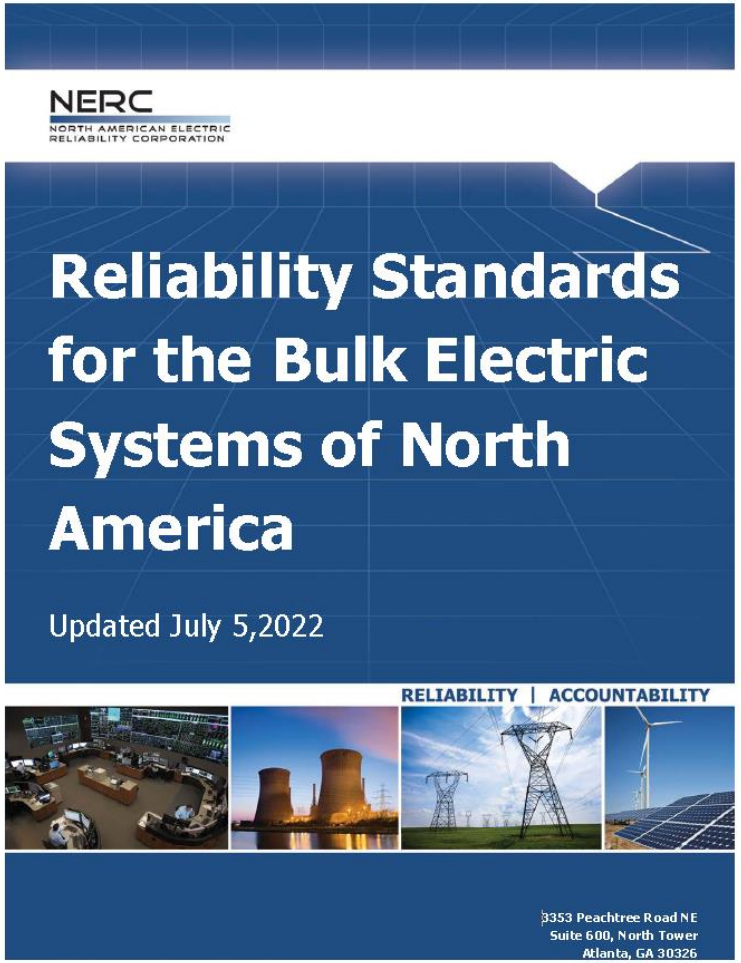
Project 2020-06 Verifications of Models and Data for Generators

Updated NERC MOD-026-2 requires:

- **Dynamic and EMT model validation & benchmarking** for IBR, FACTS and HVDC
- **Protection and limiter modeling** is also required in positive sequence and EMT models

NERC Standard Access Requests (SARs) requiring updates to following standards [approved by RSTC in June 2022]:

- **FAC-002-3 Facility Interconnection Studies** to include **EMT studies** to identify IBR interconnection risk
- **TPL-001-4 Transmission System Planning Performance Requirements** to include **EMT studies** in planning evaluation
- **MOD-032 Data for Power System Modeling and Analysis** to include **EMT models and data** for system studies



THANK YOU