Responses to Discussion Topics

During day one of the workshop, the attendees were broken up into groups and asked to discuss for a short time four different topics related to grid simulator and nacelle testing. Below are those topical questions and summaries of the participant's responses.

Discussion Topic #1: "What can't grid simulators do right now? What can't drivetrain test benches do right now?"

Summarized Response:

- Define: simulator vs. amplifier
- Amplifier
  - Limited overvoltage
    - Max voltage is 13.8 kV – may need 35 kV
  - Bandwidth (latency) range
    - 50…250 us is "typical"
    - Drives the need for compensation algorithms
    - Bandwidth limitation may limit ability to reproduce test conditions for converter internal faults
  - Power limits (HVDC, etc.)
- Simulator
  - Open digital protocol for signal passing
  - Hard real time phasor based simulators
- Operate at higher voltages, ideally at 1.8 times grid voltage. Current limits are generally 1.33 times grid voltage.
- Operate as a current source and produce/control current oscillations

Discussion Topic #2: "What capability is lacking from both the pure and real-time simulation environments?

Summarized Response:

- Component models of power elements
  - Traceable validation (for accreditation)
  - Temperature dependencies of parameters
  - Incorporating uncertainly and random noise
- Model fidelity in commercial simulation platforms geared towards distribution systems.
- Load models, perhaps these need to be more standardized for easy comparisons among plants.
- A good way to validate software models against real world data.
- Most models do not account for the heating of cables and equipment. This should be included.
- Time steps closer to real time.
- Effects of yaw action on the drivetrain and structural systems. Inertia needs to be better estimated and included in the dynamic models.

Discussion Topic #3: "How best can we learn from each other and build lasting collaborations? What would be an acceptable form? Should this be an IEA task?

Summarized Response:

- *Funding for collaborative projects*
- Better visibility of IEEE TF on RT-sim, etc.
- The simple answer is to collaborate, however, this can be difficult in a research environment
- We should form a coalition to define standards for deployed products
- Collaborators need to be sensitive to timing; university research is generally slower than commercial
- Understand vendors and their offerings insides academia
- Formalize an IEA task, hold workshops every year or two, and engage in staff exchanges

Discussion Topic #4: "Should grid simulator testing be standardized? How do we develop common test protocols and procedures? Should these be made into certification requirements?

Summarized Response:

- Non-RT test labs don't have standardized procedures
- Trying to standardize things too early may slow down progress
- Work on benchmark cases to allow different labs to "calibrate" their approach against a mutually agreed upon case (different ones for different applications)
- Standards testing: have customers/industry decide on standards for OEMs
- There should be a clear understanding if the actual interactions between components (i.e. real-reactive power flow measurements between components)