Session 5: IEEE2800	
Question	**Answer**
Does ISO/Utility require software vendors or hardware manufacturers, or other third-party consulting companies to submit white-box simulation models of IBRs?	ISO-NE does not. We require models to be as accurate as possible and as close a represention to the physical equipment as it can be which means the OEM needs to black box it. ERCOT ISO does not require either and also strives for as accurate models as possible. Many PSCAD models are black-box. ERCOT ISOs posted model quality guide also includes guidelines for PSS/e User Defined Models and PSCAD models: https://www.ercot.com/files/docs/2021/04/20/Model_Quality_Guide.zip
There was a lot about aggregation yesterday. If we require what the individual inverter is doing during a fault, doesn't that conflict with aggregation?	Ideally the aggregate model of a group of inverters or turbines captures their net response, including during faults. We know this will be an approximation for the reasons mentioned in the workshop. Except for current injection during abnormal voltage, IEEE 2800 avoids inverter-level requirements, instead including plant-level requirements. However, those plant-level requirements of course have implications for inverter-level performance. Also, for event analysis, IEEE 2800 does require high speed data collection in the IBR units during faults for giving visibility into the inverter behavior.
Can P current drop be balanced with Q priority? In Odessa 2022 event in ERCOT most affected units dropped to 0 P current, raising UFLS triggering concerns.	All IBRs are total current limited equipment. Therefore vector sum of active and reactive current needs to limited to total current limit during fault. During voltage dip, it is important to get the voltage back before active power can be injected. Once voltage recovers, automatically demand for reactive current will reduce and will allow more active current to reocver active power deliver. Therefore there is not much use of more active current while voltage is very low as that will not help with active power delivery
Any of the presenters can mentione the main differences between the IEEE P2800 and the IEC 61400 family of standards for wind systems. Thank you.	The IEC 61400 family of standards are design standards for wind generation systems (applicable to individual WTG). The IEEE 2800 is performance based standard (applicable to wind plant). The IEC 61400 standards are referenced in IEEE 2800. It is not practical to compare wind turbine generator design standard with a plant level performance standard. As appropriate, the IEEE 2800 WG did consider design requirements in IEC 61400 while developing plant level performance requirements.
What are the gaps between NC RfG in IEEE 2800?	This will require a detailed GAP analysis and it is not within scope of IEEE 2800 - 2022 WG to do any GAP analaysis of IEEE 2800 - 2022 std with any other existing std.
Are the ERCOT protocols public? I have had to make special requests to download because I do not live in the USA	They are public but not possible to access from outside USA

How is ISO-NE certifying today that resources are meeting current requirements? what would be the difference with the new requirements in 2800?	ISO-NE verifies conformance with the current requirements through data requests during the interconnection process, and via comissioning testing. We rely heavily on the developer giving us correct information. Under IEEE 2800 we would seek more definitive testing to both validate and verify the conformance from the OEM.
Can adoption of (or compliance with) IEEE P2800 by OEM eliminate the need for ISO to do EMT studies?	Unfortunately no, because the plant-level performance needs to be verified, not just the device-level conformance. It is possible device-level testing by OEMs could reduce the need for EMT studies, but it would not completely eliminate it. In addition to verifying plant level performance with IEEE 2800, EMT studies might also be done to evaluate system performance.
On an NATF meeting held yesterday, FPL presentation stated they have adopted P2800.	That's a good news.
Who is going to pay the generators for this reactive power ancillary service at 0 MW real power output - especially in energy only markets?	The IEEE 2800 WG focused on capability requirements and not on utilization of specified capability. The ancillary services agreements are between two parties and out of scope of IEEE 2800.
Are inverters primarily 3-phase or single phase? Can/do 3-phase inverters provide fault current for single-phase fault without needing energy backup?	Transmission and subtransmission-connected inverters and converters are typically 3 phase. Yes, typical 3-phase converters and inverters can be designed to provide positive and negative sequence fault current for single-phase faults without energy backup.
how do the IBR support the electrical system from the point of view of frequency adjustment and adjustment reserves and how?	IEEE 2800 describes two ways IBRs can support grid frequency: primary frequency response and fast frequency response. See clause 6 of IEEE 2800. Many IBRs already did this prior to the publication of IEEE 2800 as well. The assignment of reserves to enable this can be decided by a market or by a system operator.
whether the IBRs take part in frequency regulation is this a limitation of production or by installation of storage means such as batteries. or is the Tso the only one who will provide this system service?	IEEE 2800 - 2022 does not require any limitation of production or installation of battery for under frquency support per primary frequency response (PFR). It only defines the capability how such capability will be utilized will be between grid operator and plant owner. For fast frequency response, no explict mean is stated for any resource, but for Wind Turbine Generator, it can be done by extracting addtional active power from rotational kinetic energy. This will have a much longer recover period
Jason - Should the default IBR reactive controls be limited to "Plant level V control + local coordinated V/Q control"?	During normal operation condition plant level voltage control is performed by plant controller that in turn send either Q or V ref to individual IBR unit. During fault ride through mode, plant controller is frozen and individual IBR take over their own terminal voltage control
how is managed the telecommunication system dedicated to the management of the electrical system in the face of the massive integration of IBRs.	Do not understand this question.

Will 2800 impact state rules related to interconnections on what we call high voltage distribution 47 kV to non transmission 138 kV?	IEEE 2800 applies to all transmission IBR interconnections and can be applied to subtransmission IBR interconnections, with voltage levels as defined by the utility. A utility could decide to apply IEEE 2800 to its 47 kV and 138 kV interconnections.
Re inst AC voltage measurements used for ride-through - does 2800 specify how this should be measured in terms of required sample rates and/or filtering?	The IEEE 2800 does not specify how AC voltage is measured and used for ride-through, however, when used in a voltage protection function, the standard requires use of filtered quantities to reduce posibility of misoperation.
What are your thoughts on NERC proposal to modify PRC-024-3. Do you think NERC should closely look at the requirements in IEEE 2800 and incorporate in PRC-24-3	It would be great if NERC were to align their requirements with IEEE 2800 where applicable.
For ISOs: Regarding your concerns on adopting 2800 before 2800.2 is published, how do you currently verify that your interconnection requirements are met?	Good point. There is a set of tests described in protocols and operation guides with regard to every requirement that ISO has. And similar tests can be developed with regard to new requirements if adopted from IEEE2800.

Please go over the NOPR vs IEEE 2800 conflicts since we need to comment on the NOPR next week. All detail would help. Happy to take this question off line.	During voltage conditions within "no trip zone" defined by NERC Reliability Standard PRC-024 or its successor standard, the NOPR requires generating facility to maintain active power production to pre-disturbance level (except when providing primary or fast frequency response). The NOPR also requires generating facility to provide dynamic reactive power to maintain system voltage in accordance to generating facility's voltage schedule. For small disturbances (voltage at POM remains between 90% and 110%), it is OK to expect generating facility to maintain active power production to pre-disturbance level while also providing dynamic reactive power to help maintain system voltage in accordance with generating facility's voltage schedule. However, for large disturbances (voltage at POM is below 90% or above 110%), referencing of "provide dynamic reactive power to maintain facility's voltage schedule" when plant is operating in a ride-through mode in itself is incorrect. Concept of maintaining voltage schedule is appropriate for small voltage disturbances where voltage does not deviate too far from nominal. During a large disturbance and given a timeframe of PRC-024 (order of few seconds), plant can't be successful in maintaining voltage schedule anyway. Power is a function of voltage and when voltage is abnormal during a large disturbance, generating facility may not be able to maintain active power production to pre-disturbance level. The generating facility could maintain active current (and not power) to pre-disturbance level or could increase active current above the pre-disturbance level during a disturbance. This is known as active current priority mode. However, recognizing that inverters are current limited devices, and to support voltage recovery, it may be preferred that reactive current is increased while compromising active current during a large voltage disturbance. This is known as reactive current priority mode. Should generating facility operate in an active current priority or reactive current priority mode be based on system studies? Even when reactive current priority is used, how much reduction in active current is allowed to prioritize reactive current is configurable by properly selecting control parameters. This NOPR effectively removes an option for generating facility to operate in reactive current priority mode. At this time, most in industry requires non-synchronous generating facilities connected to HV and EHV transmission system to operate in reactive current priority mode. Instead of requiring plant to maintain active power production to pre-disturbance level during a large voltage disturbance, the plant should be required to return to pre-disturbance power level quickly once voltage returns to nominal.
Question to OEMs, will full adoption of IEEE 2800 significantly raise equipment cost?	This question was asked and answered during the workshop.
How long should it take for FERC to adopt IEEE2800? Is there some way to know which ISOs & organizations have adopted it and which ones haven't?	We can't speak for FERC. At this time, many ISOs/RTOs/Utilities are reviewing IEEE 2800 and developing a road map for adoption.
Should ISO/RTOs move forward with 2800 implementation through modified GIAs or is it likely these efforts would be superseded by FERC action on pro forma GIA?	We can't speak for FERC. At this time, many ISOs/RTOs/Utilities are reviewing IEEE 2800 and developing a road map for adoption.
When an RTO considers adopting IEEE P2800, what are some major barriers that might lead them to not adopt? E.g. cost, feasibility, testing, etc	This question was addressed and answered during the workshop.