



## Interconnection Process: Symptom or Solution – OEM Perspective

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# The Interconnection Process is Broken

## When Considering Grid Reliability

- The goal of the Interconnection Process is to connect as many resources as possible
- ISOs/TSPs have motivations to meet political renewable energy goals
- Developers have motivations to build and operate or sell as many resources as possible
- Consultants have motivations to get as many studies done efficiently as possible
- OEM have motivations to sell IBR



# Process and Implementation is the Root Cause

## Not Necessarily the Players

- ISO/TSP need to trust the data they receive
- OEMs may not always be asked to provide the right model for the right task
- Developers may not have the technical expertise to request the correct study inputs or to review study results
- Consultants need to utilize only the inputs described in their scopes and carry out only the defined scope



# Where are the Gaps?

## Overall Lack of Knowledgeable Resources

- There is a large deficiency in modelling experts
  - Frequent pushback against new studies and processes because of the lack of resources to perform the work and costs associated with developing these resources
- There are very few tangible consequences for submitting poor data (as long as the data responds well)
- Business and political goals most often have higher priority than grid reliability
- Scope blindness

**Inaccurate Models = No connection = No sales**

Models are required through the entire project life cycle, and they become more demanding as markets mature.





# How Can We Fill These Gaps?

More Knowledge in the Industry and Better Data

- All participants in the Interconnection Process should have a thorough understanding of what is being studied, why it is being studied, and how the inputs effect the results
- The interconnection Process needs better inputs
  - Additional verifications and validations early in the study process to show plant model accuracy
  - Better due diligence from Developers and consultants with regards to using the best data at each step
  - Knowledge, resources, and regulatory tools at the Governmental and ISO/TSP level to ensure there is a motivation to submit accurate data at every single step

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# What is Vestas Doing?

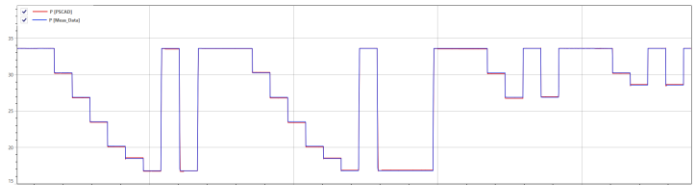
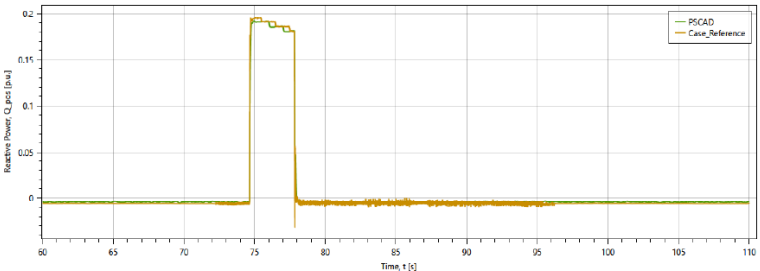
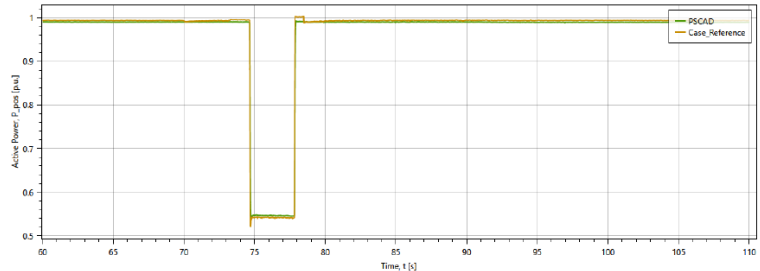
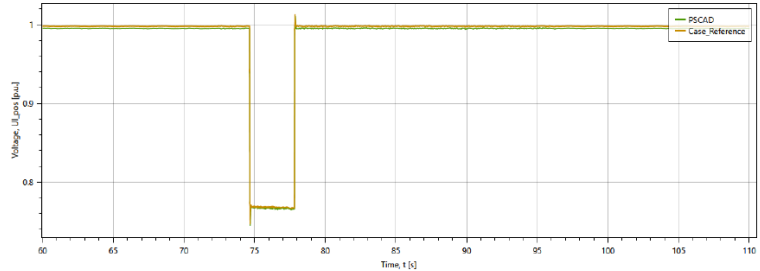
Increasing Industry Knowledge and Pushing for Better Practices

- Numerous discussions with customers, ISO/TSP, and Industry Groups to promote proper model use and practice
- Providing validation reports for most all models
- Updating all in-service and proposed plants with site-specific models
- Providing dynamic and tuned solutions to mitigate unnecessary transmission expansion
- Working in an Officer's Role on IEEE P2800.2



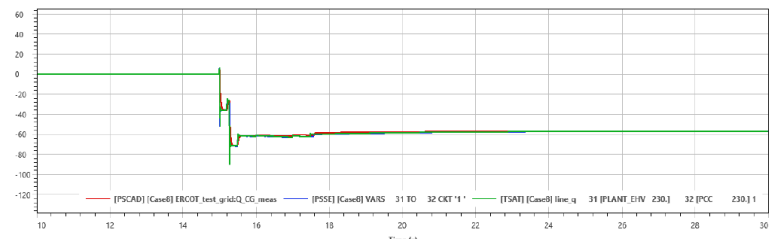
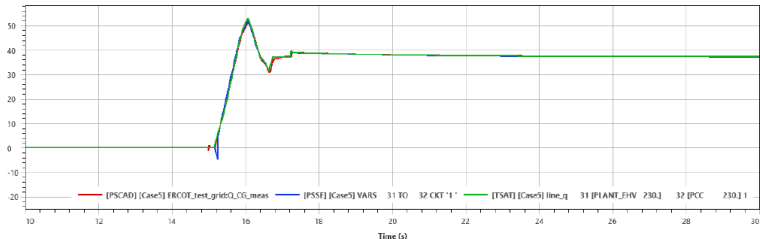
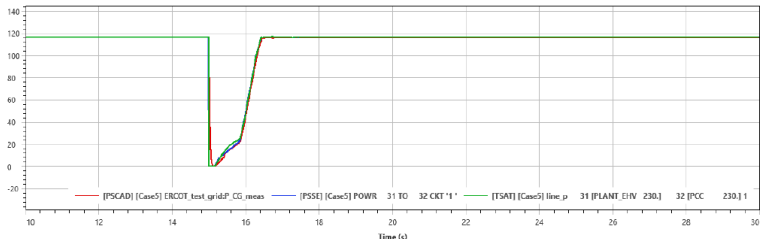
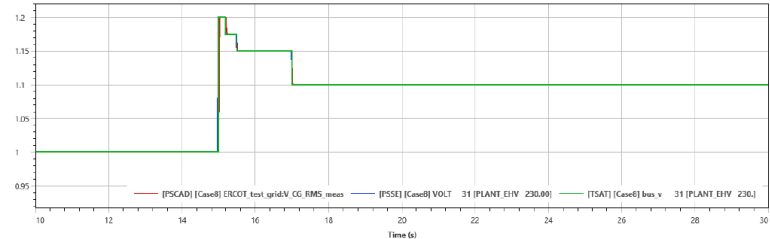
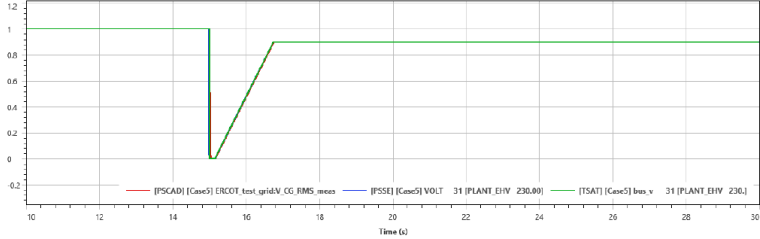
# Vestas UDM Results Versus Reference Data

## WTG Fault Ride Through and PPC Frequency and Voltage Reference Changes



# Vestas UDM Results Across Different Software

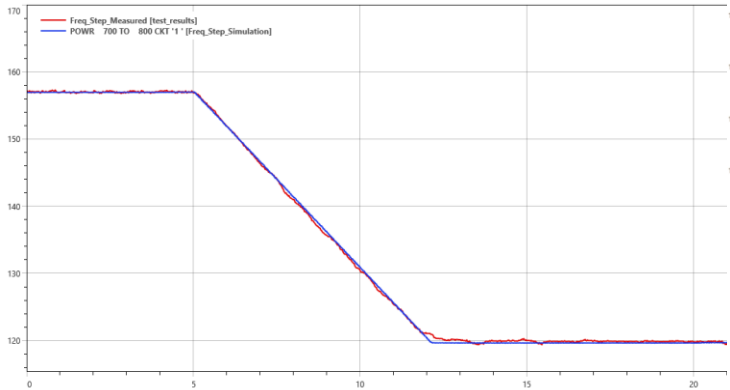
## High Voltage Ride Through and Low Voltage Ride Through





# Vestas UDM Results Versus Site Measured Response

Direct Parameter Download from Site Software Produces Results Within 1% of MOD-026 and MOD-027 Tests





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Questions

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