

# Overview of Inverter-Based Power Plant Model Validation

P. Pourbeik

[ppourbeik@peace-pllc.com](mailto:ppourbeik@peace-pllc.com)

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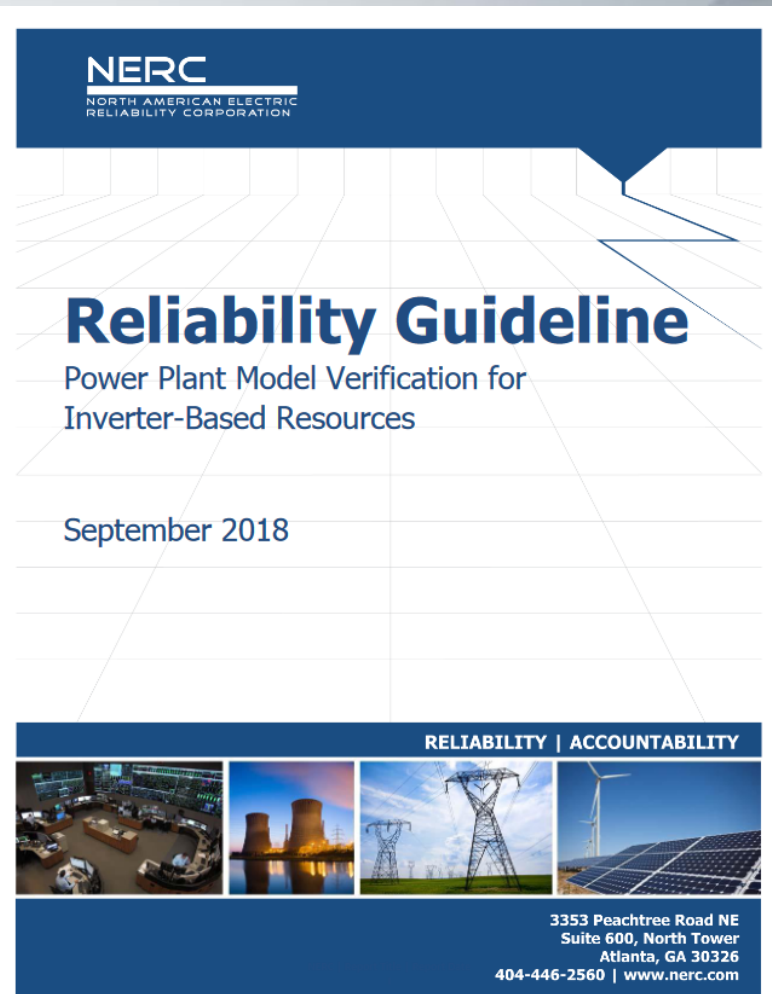


# Modeling Validation for IBR

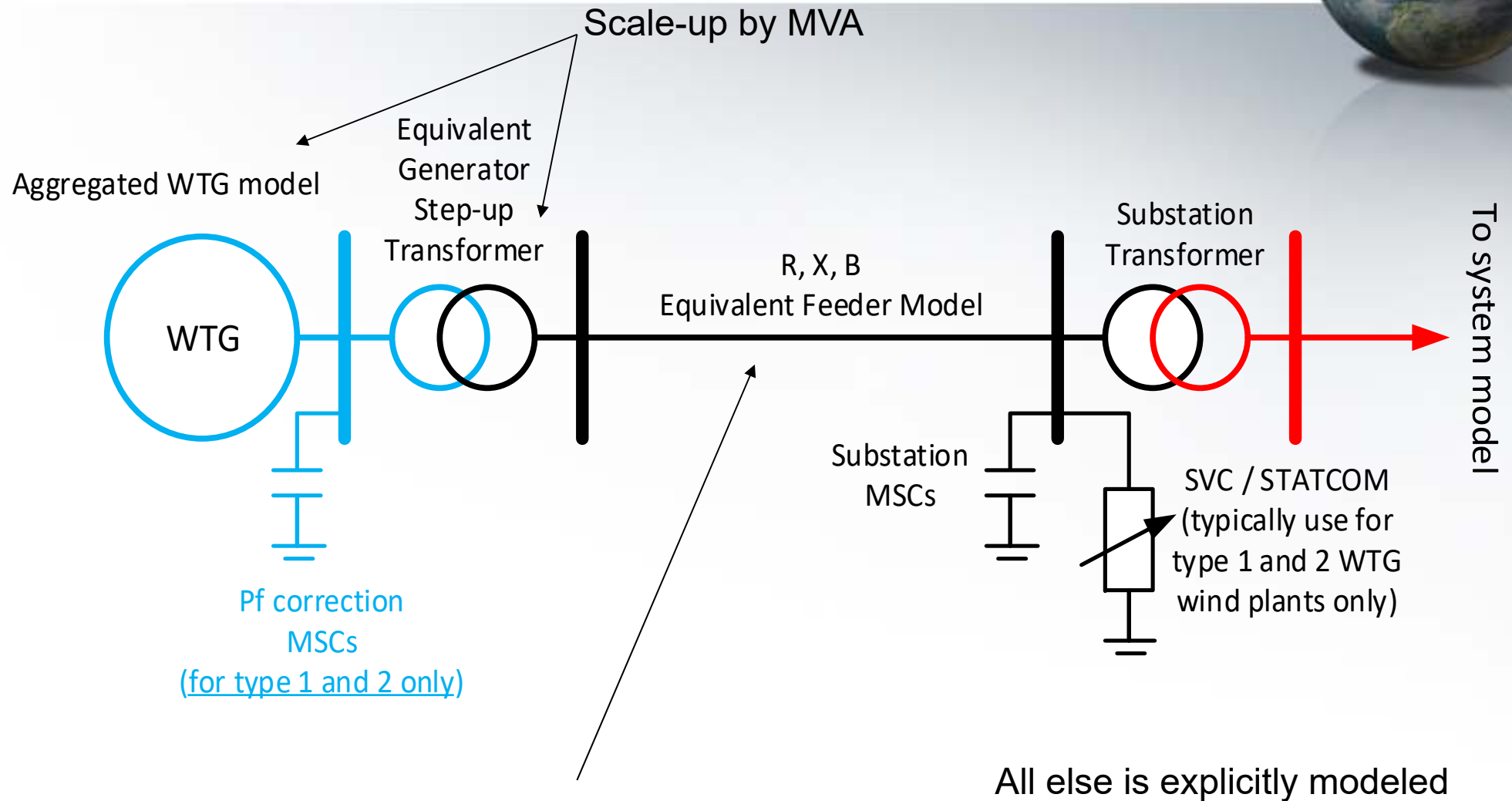


*NERC Reliability Guideline:  
Power Plant Model  
Verification for Inverter-  
Based Resources,  
September 2018*

[https://www.nerc.com/comm/  
PC\\_Reliability\\_Guidelines\\_D  
L/PPMV\\_for\\_Inverter-  
Based\\_Resources.pdf](https://www.nerc.com/comm/PC_Reliability_Guidelines_D/L/PPMV_for_Inverter-Based_Resources.pdf)



# Wind Power Plant



NREL Approach [1]



# PV/BESS



Same Concept as for Wind



# Type 1 & 2 WTG



- These are passive turbines
- There are no safe and useful field tests that can be done
- If there is monitoring (e.g. PMU/DFR) at the POI and “by chance” a significant event is captured, an attempt can be made of disturbance based verification
- Otherwise, engineering calculations to verify data



# Type 3 & 4 WTGs; PV and BESS



## Volt/Var Testing: (NERC-MOD-026-1)

- Switch nearby large transmission MSC
- Switch MSC in collector system
- Voltage reference step tests on the plant-level controller

## Frequency Response Testing: (NERC-MOD-027-1)

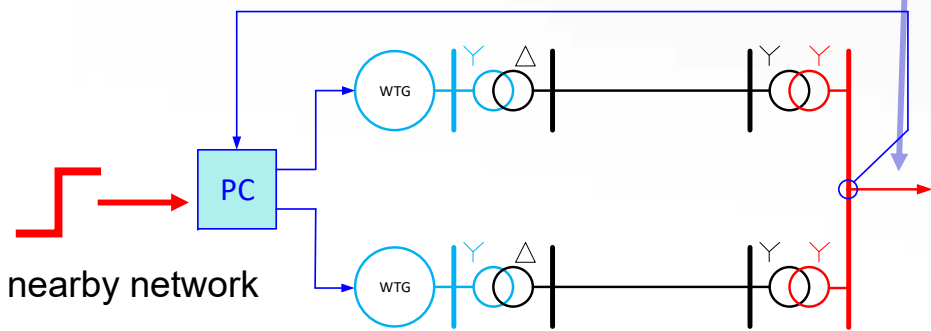
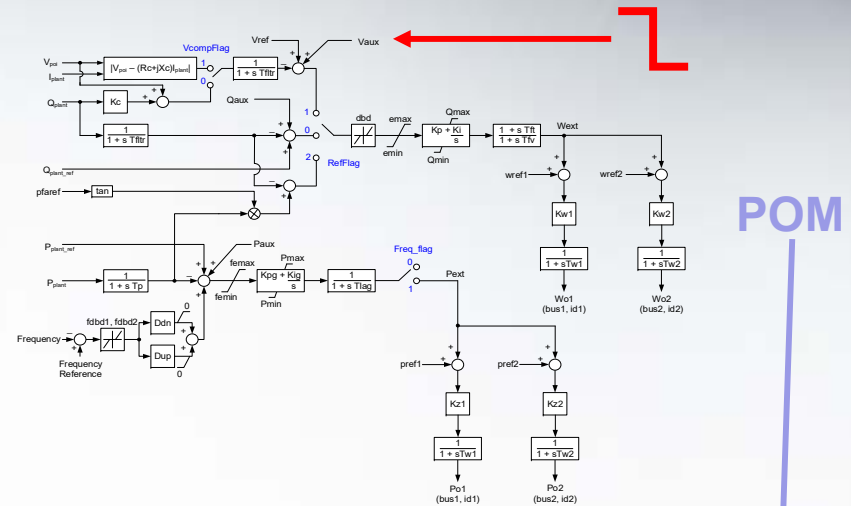
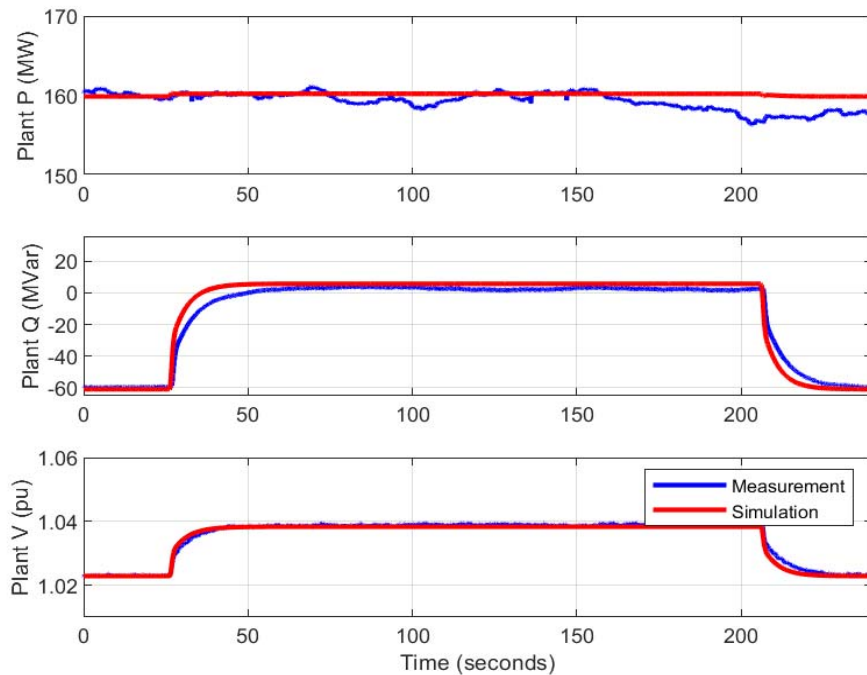
- Plant has none – prove with disturbance recordings
- If a plant has PFR – frequency reference step tests will work and/or disturbance monitoring (required by FERC Order 842 for all plants built after February 15, 2018)



# Plant Level Vref Step Test



## Vref Step test at the plant level



Simulated in GE PSLF™ with full representation of nearby network

This slide is from P. Pourbeik, S. Wang and N. Etzel, "Utilizing the REPC\_B model for Validation", August 26, 2020;

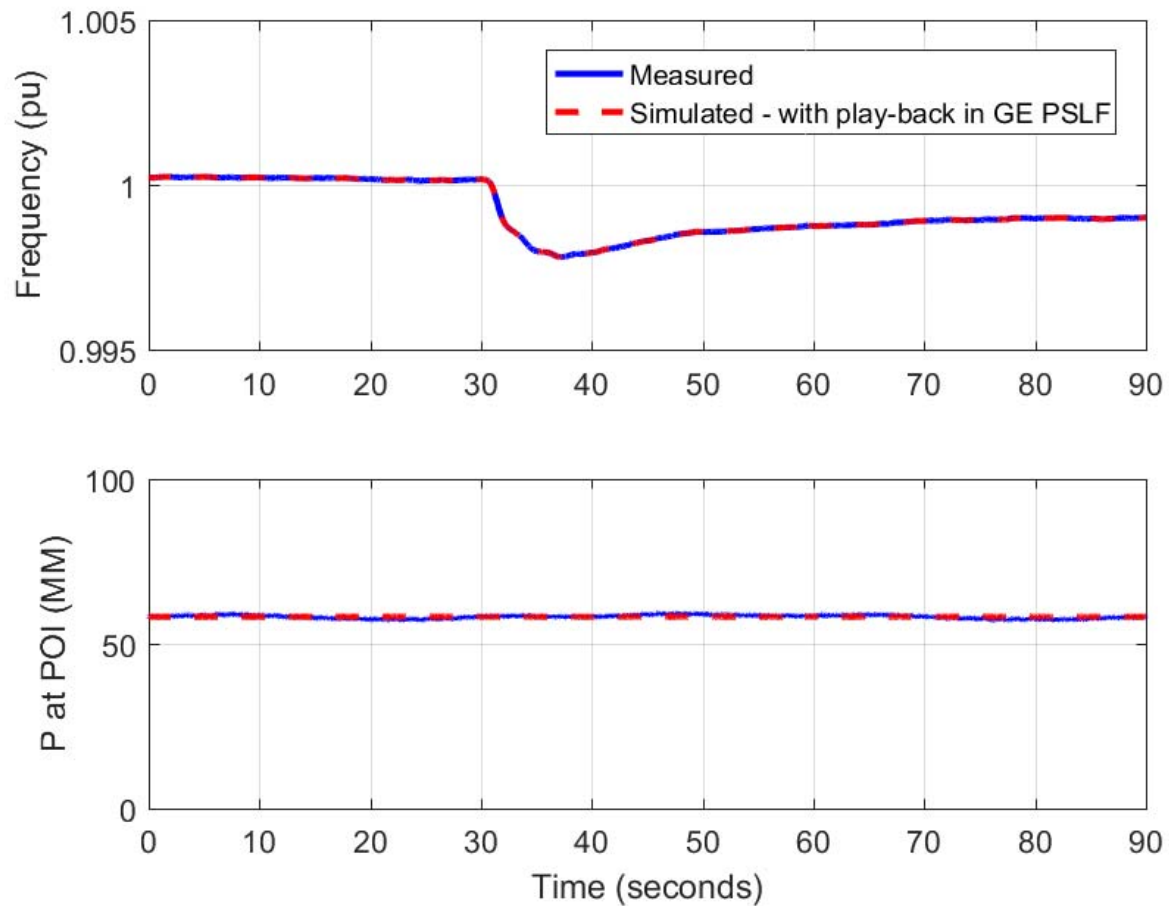
<https://www.wecc.org/layouts/15/WopiFrame.aspx?sourcedoc=/Administrative/Pourbeik%20-%20Utilizing%20the%20REPC%20Model%20for%20Validation.pdf&action=default&DefaultItemOpen=1>



# Frequency Response (PMU recorded)

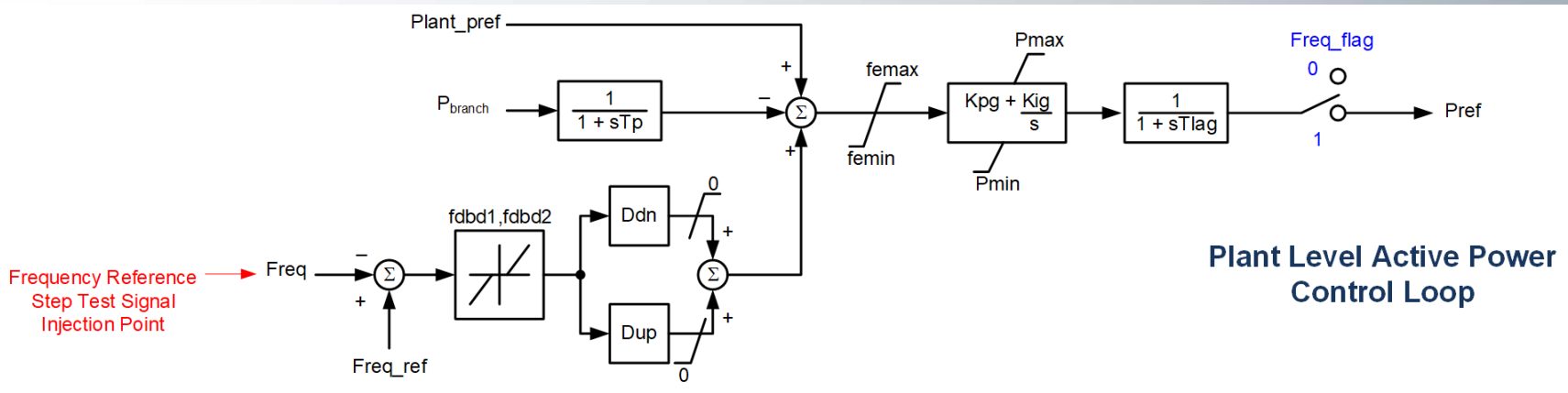


Older Plant With No PFR Controls

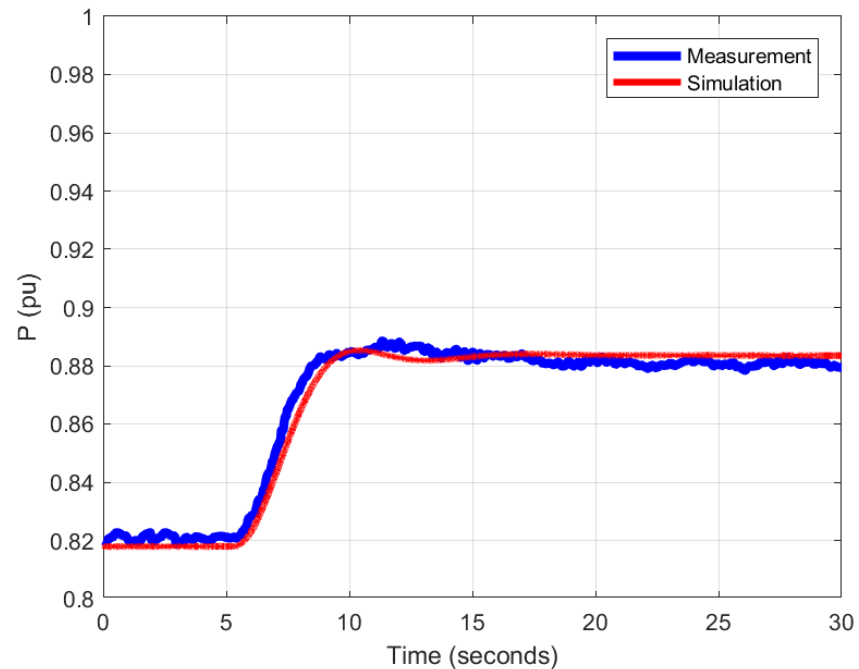




# Frequency Response Step Test



- WTG (type 3 in this case) with actual primary frequency response controls enabled
- Validation with Freq. Ref. Step test using 2<sup>nd</sup> generation generic models



# Conclusion



- Can verify models based on:
  - Disturbance monitoring
  - Field Tests
- On power-electronic based IBR technologies can easily perform  $V_{ref}$  and  $F_{ref}$  step-tests
- Individual inverters should be type tested (typically in the factory) and model parameters provided by OEM

