U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

SOLAR ENERGY TECHNOLOGIES OFFICE

Let's work together on fast time-scale modeling of power systems with high distributed solar generation

Solar Energy Technologies Office

Systems Integration

November 16 & 17

energy.gov/solar-office

Agenda – Day 2

November 17			
Time (ET)	Organization	Presenter	Topic/ Title
12:00	DOE/SETO SI	Kemal Celik	Introduction & Summary on Day 1
12:20	ERCOT	John Schmall	IBR Integration Experience and Needs from ERCOT Perspective
12:40	USF	Lingling Fan	Design of dynamic models and analysis tools for solar PVs under large grid disturbances and weak grid conditions
13:00	NCSU	Ning Lu	Photovoltaic analysis and response support platform
13:20	ORNL	Suman Debnath	Library of advanced dynamic models of large-scale PV and PV-grids
13:35	GE	Maozhong Gong	Holistic modeling to analyze and improve the stability of IBR systems
13:50	NREL	Jin Tan	A hierarchical optimal control framework that leverages the fast response capability of IBRs
14:05	Break		
14:45	PNNL	Wei Du	Integrated multi-fidelity model and co-simulation platform for distribution system transient and dynamic analysis
15:00	PNNL	Wei Du	Introduction to universal interoperability for grid-forming inverters consortium
15:10	ANL	Dongbo Zhao	Performing transient and dynamic analysis of multiple levels of the power systems with renewable components
15:30	BNL	Peng Zhang	Ultra-scalable modeling and analytics of PV systems using of neural ODEs.
15:45	NREL	Andy Hoke	Improving the modeling accuracy and performance of analysis of transient dynamics of large-scale power grids with extensive IBRs
16:00	Q&A		
	Adjourn		

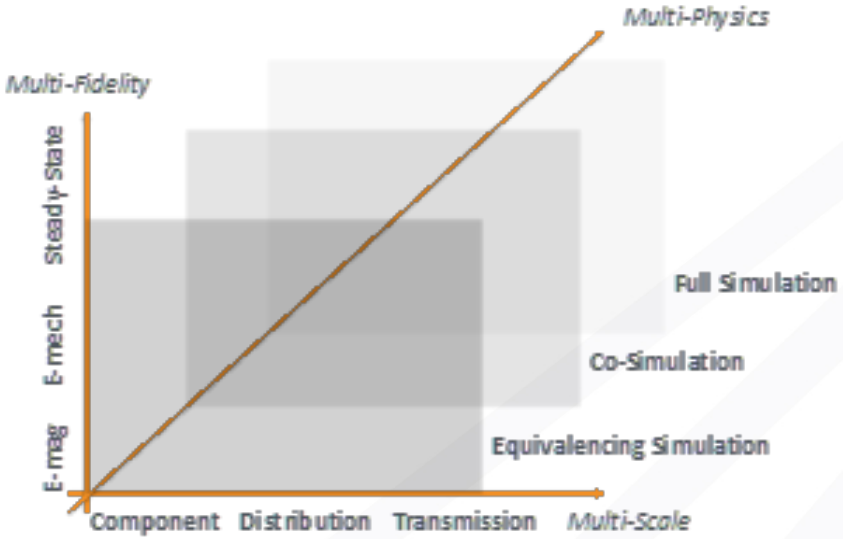
Focus on Transients and Dynamics

- Fast temporal behavior of bulk-power system and distribution networks affects the grid in a very fast & an interactive manner
  - The need for fully integrated simulation is also driven by the certain and significant future increase in BTM generation, storage and controllable variable loads.
  - It is important to better understand the transient and dynamic behavior of the fully integrated grid
    - **More Distributed:** The grid trends to having many small active resources such as rooftop PVs, smart appliances, and electric vehicle
    - **More uncertainty:** Uncertainties increase due to variable generation, smart loads, electric vehicles, generation and network contingencies, weather and cyber events, and hidden failures
    - **Lower inertia:** Power electronics-connected generation and consumption reduce the mechanical inertia in the system
  - Webinars include presentations on modeling and analyzing the transient and dynamic behaviors of various elements of the electric power grid, including load and distributed solar PV generation

Past & Current Projects and Programs

- Lab Call FY16 - SI Sunlamp Projects
  - Projects with components on dynamics and protection
- Lab Call FY19 – SI
  - Exclusive projects on dynamics and transients
- Lab Call FY22 – SI
  - Exclusive Topic Area
- FY18 SI ASSIST FOA
- FY19 SI FOA
  - Exclusive Topic Area
- FY20 SI FOA
- FY21 SI FOA
  - (Grid-Forming Technologies Research Consortium)

Many Challenges (Dimensions) - Solutions



		Data	
		Same	Different
Analysis	Same	Reproducible	Replicable
	Different	Robust	Generalisable

Whitaker (2018) https://doi.org/10.6084/m9.figshare.7140050.v2

Lab Call – FY22 – (one of the) Core Topic(s)

(OEDI – Solar Grid Integration Data & Analytics Library)

- Main goals
  - Provide access to data, data integration & mapping information/scripts
  - Physics-/network- & data-/ML-based solar analytics
  - Enable reproducible, robust, replicable and generalizable R&D in simulation and emulation of solar system integration
  - Encourage/enforce dataset format/I/O standardization
- Main deliverables
  - Generic and integrated datasets from four power systems operation technologies
    - smart inverters/distributed energy resources management systems (DERMS)
    - phasor measurement units (PMUs) and data concentrators (DCs)
    - smart meters/advanced metering infrastructure (AMI)
    - new sensor technologies
  - Benchmark analytics (physics and ML based algorithms)
    - Distribution state estimation
    - Optimization functions
    - Transients analysis
    - Data interfaces (CIM, OpenDSS, Gridlab-D)

Open Energy Data Initiative (OEDI)