‘Partial’ lit review

SAND2015-11084R - Dynamic Simulation over Long time periods with 100% solar generation

https://prod-ng.sandia.gov/techlib-noauth/access-control.cgi/2015/1511084r.pdf

Summary: Uses eigen value analysis to investigate stability of integration methods applied to dynamic simulation of power systems with photovoltaic sources.

Relevance: Uses PST to investigate similar topics as SETO project. Provides suggestions on integration methods and introduces a procedure to test integration method applicability based on analysis of system eigen values.

PST Manual and Software available from:

https://www.ecse.rpi.edu/~chowj/

Relevance: Open source transient simulation software

Sub-Hour Solar Data for Power System Modeling from Static Spatial Variability Analysis

56204 - NREL

https://www.nrel.gov/docs/fy13osti/56204.pdf

Summary: Focus on statistically modelling sub-hour (minute) solar data and comparing to measured data. Provides some characteristics of variable solar irradiance.

Relevance: Possible source for relevant event data to simulate

MAFRIT == Multi-Area Frequency Response Integration Tool

https://github.com/NREL/MAFRIT

Summary: Based on MATPOWER load flow solver. Models machines, governors, wind turbines and AGC in the long-term. Meant to function in the ms to minute range of dynamic simulation.

Relevance: Similar aim as this project with a focus on economic scheduling. Possible replacement/update of MIDAS?

64637 - NREL Investigating Power System Primary and Secondary Reserve Interaction under High Wind Power Penetration

https://www.nrel.gov/docs/fy17osti/64637.pdf

Summary: Uses Flexible Energy Scheduling Tool for Integrating Variable Generation (FESTIV) and MAFRIT to investigate primary and secondary frequency response in a multi-area system.

Relevance: Use case example of the MARFRIT NREL software package to do long-term simulation. While focusing on wind generation, similar concepts may apply to PV generation.

PSLTDSim - Power System Long-Term Dynamic Simulator

Github code source: https://github.com/thadhaines/PSLTDSim

Master thesis location: https://github.com/thadhaines/Thesis-Release/blob/master/200501-haines-thesis.pdf

Summary: Uses time sequence power flow, combined system frequency, governors, and AGC to model long-term power system dynamics in Python. Relies on PSLF for system dynamic and topographic information, as well load flow solver algorithm. Does not focus on transients / sub second system responses.

Relevance: Long-term simulation of power system dynamics. Shows that time-sequenced power flow can be used to model primary and secondary frequency response.

POWER SYSTEM SIMULATION USING AN ADAPTIVE MODELING FRAMEWORK

https://digitalcommons.mtech.edu/grad\_rsch/76/

Summary: Master thesis describing software that switches between classical transient simulation and long-term time sequenced power flow simulation.

Relevance: Possible approach/idea to consider for long-term simulation if variable time step/ multi-step integration proves unsatisfactory.

Fast Frequency Response Concepts and Bulk Power System Reliability Needs NERC Inverter-Based Resource Performance Task Force

https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/Fast\_Frequency\_Response\_Concepts\_and\_BPS\_Reliability\_Needs\_White\_Paper.pdf

Summary: Provides background into basic frequency response and control, factors in rate of change of frequency (ROCOF), inertia effects, technology-specific FFR capabilities (wind turbine, solar, and battery...).

Relevance: Provides information and illustrations of system impacts due to fast frequency response from various sources. Models of these technologies may be useful to consider for this project.

*The following slide decks may not provide much 'substantive' information, but do provide references with more detail of topics that may prove to be of interest.*

Integrating High Levels of Variable Renewable Energy into Electric Power Systems

68349 - NREL

https://www.nrel.gov/docs/fy17osti/68349.pdf

Summary: Overview of where things are, and are going (relative to publication date), in relation to integration of renewables/inverter based energy.

Relevance: Provides challenges, solutions, and references related to variable renewable energy topics.

Grid Integration of Variable Renewable Generation: Reliability Challenges and Solutions

72615- NREL

https://www.nrel.gov/docs/fy19osti/72615.pdf

Summary: Similar to other NREL slide deck

Relevance: Info and sources on increasing solar/wind usage. Interesting comparison graph of reactive power capabilities of various sources (generators, inverters ... ). Places MAFRIT in dynamic simulation time scale spanning ms to multiple minutes