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CEC Grid Modernization Research Workshop

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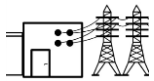
Technology Advancement to Help Address Future Grid Challenges

Grid Inertia

- Increase in the number of Inverter Based Resources (IBR) both at the distribution and transmission level
- Phase-out large conventional generation continues to take place
- It continues to be a matter of balance between load and generations with different type of resources
- IBR's react faster to transients which results in faster grid inertia changes



Grid Congestion

- Increase demand due to overall electrification (e.g., EV's, building electrification, industrial electrification)
- Distribution system evolving from one-directional power flow (source to load) to bi-directional power flow (source anywhere in the distribution circuit)

Power Quality

- Load and generation resources are becoming more sensitive to the quality of power (consumed and generated)
- Increase in the use of power electronics in the generation, transmission, distribution and consumption of energy which non-linear operation is not only sensitive but also be responsible for the quality of the power
- IBR's if not properly coordinated (controls coordinating) and evaluated for system impact could deteriorate power quality

Cybersecurity

- Smart assets required fast and secure communications
- Reliability is no longer just about the reliability of the grid and its assets but the reliability of its communications

Potential Research Gaps

- Faster and secure controls
- Planning and operational tools to address challenges posed by the increment of Inverter Base Resources (IBR) on the grid (panning and operational)
- Situational awareness tools for real-time and post-transient analysis based on AI and ML
- Grid technologies with the ability to dynamically control power flow
- Application of Solid-State technologies in transmission, distribution, gird edge and substations
- Tools to better assess the impact from non-linear loads/generation to the grid and its existing assets
- Short- and long-term energy storage needs (beyond Li-Ion)
- Application of Artificial Intelligence (AI) and Machine Learning (ML)
- Robust and secure communications

Look at other R&D efforts

- Europe and Asia are evaluating the use of DC systems in low, medium and high voltage applications
- Other countries continue to install and operate off-shore wind resources (how are they dealing with it?)
- Electricity is key to the development of electric mass transportation systems (e.g., high speed rail and light-rail) Europe and Asia have advanced
- Work and learn from other industries R&D effort and no limit to the utility sector

Collaboration Opportunities

- Continue to collaborate with National Labs by leveraging their knowledge and lab resources
- Collaboration among the California IOU's and with utilities from other states and countries
- Leverage the academic institutions and researchers
  - Support University Researcher and research lab facilities
  - Workforce development opportunities
- Continue to explore opportunities with existing and new technology vendors
- Find opportunities for broad team collaboration that includes state agencies, DOE, national labs, universities, commercial research institutions, startups, etc.

Other Opportunities

- Identify opportunities in which our disadvantage communities could benefit from R&D effort and its results
- Ways to leverage state and federal R&D funding to solve common problem
- Identify R&D areas that are probably missing or not much effort is taking place
- Workforce development is key in all areas
- Support new research facilities (e.g., university labs)