Distributed Energy Resources and Electric Reliability

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Outline

• Drivers of DER Deployment
• Barriers to DER Deployment
• Key Reliability Challenges
• Advanced (or “Smart”) Inverters
DER Drivers

• State (and Federal) Incentives and Mandates
• Customer Choice:
  • Environmental Ethics
  • Declining Costs of Solar PV
  • Compensation at Retail Rates
  • Financial Options
• Market-driven deployment of DER is expected to reach 17,900 MW (10.5% of Western Interconnection Peak Demand) by 2026
DER Policies

Policies aimed at encouraging rooftop PV in the West
Barriers to Deployment

• Ratemaking Equity Issues
  • Utility Fixed Cost Recovery
  • Cost Shifts to Non-participants
  • Compensation for DER Benefits
    • Avoided Distribution Investment
    • Avoided Transmission Investment
    • Avoided Generation Investment
    • Avoided GHG emissions

• Reliability Issues
  • Simultaneous Tripping
  • Frequency/Inertial Response
  • Balancing/Ramping Requirements
Key Reliability Challenges

- Simultaneous Tripping: Small deviations in frequency and voltage can result in the tripping of a large number of solar PV systems. This can turn a small contingency into a large contingency.

- Frequency Response: High penetrations of inverter-based generation may result in insufficient inertial and primary frequency response.

- Intermittency: Diurnal pattern of solar PV generation creates operating challenges for the dispatchable generation fleet (e.g. CA “duck curve”).
Advanced Capabilities

Mandatory functions for all new inverter-based systems in California (most required in Hawaii, too):

1. Anti-islanding
2. Frequency Ride-through
3. Voltage Ride-through
4. Ramp Rate Limits
5. Soft Start Ramping
6. Adjustable Fixed Power Factor
7. Reactive Power Support
Frequency Ride-Through and Response

Anatomy of a Frequency Excursion with Recovery

For illustrative purposes only. This is not real data. Actual trip settings and operational modes are different for each interconnection and not fixed at the levels shown.
Final Message

• Advanced inverters can help mitigate the DER ride-through issue and with aggregation may be able to help provide fast frequency response (synthetic inertial response).

• Be proactive. Retrofitting large numbers of DER systems to add advanced capabilities is very expensive.
Thank You

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