

Achieving High Penetrations of PV: Streamlining Interconnection and Managing Variability in a Utility Distribution System



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Achieving High Penetrations of PV: Streamlining Interconnection and Managing Variability in a Utility Distribution System

The Department of Energy, EPRI, Sandia and NREL have joined forces in this workshop. It will focus on PV systems operating in the utility system:

- Operational issues
- Update interconnection rules and regulatory actions
- Address PV lessons learned from high penetration scenarios
- Identify best practices for distributed generation problem mitigation
- Discuss technology advancements.

The Learning Objectives Are to:

- Describe how high penetrations of PV will affect the utility system, its design and operation
- Discuss national interconnection standards and codes, efforts and latest best practices on PV interconnection regulations from around the country
- Explain utility information needs, processes, and procedures for connecting PV systems to the grid
- Discuss inverter manufacturer hardware, firmware and software requirements in light of changing interconnection codes and standards
- Describe research and updated procedures for interconnection of PV on distribution feeders and transmission
- Solicit feedback to identify additional issues, approaches and recommendations for future actions

Regulatory Landscape for High Penetration PV in the Distribution System

(Roger Hill, SNL - moderator)

- Updating Interconnection Screens and Standards (Mike Coddington, NREL)
- California PUC Rule 21 and Hawaii PUC Rule 14H (Kevin Fox, IREC)
- California Solar Initiative RD&D Work Effort (Kristen Nicole, EPRI)
- Technical Issues Identified in FERC Proceedings (Roger Hill, SNL)
- Moderated Discussion

Challenges and Issues for Interconnecting High Penetrations of PV on the Distribution System

(Kevin Fox, IREC - moderator)

Overview of Key Challenges and Mitigation Options for Utilities in Managing Distributed PV – Managing PV Variability (Robert Broderick, SNL)

- Understanding and Addressing High-penetration PV Issues Through Analysis of PV Integration in Florida Utility Circuits (Rick Meeker, FSU)
- Case Study Examples Illustrating Modeling of PV for Distribution Planning and Analysis deling PV on Distribution Systems (Jeff Smith, EPRI)
- Integrating Renewable Energy in PJM (Kenneth Schuyler, PJM Interconnection)
- Moderated Discussion

Technology Advancements in Power Electronics and Advanced Inverter Solutions

(Kristen Nicole, EPRI - moderator)

- Monitoring and Visualization Efforts for PV and Distribution Systems (Jason Bank- NREL)
- Looking Ahead – EPRI R&D – Advanced Technologies to Manage and Integrate Distributed PV (Aminul Huque, EPRI)
- Updating National Interconnection Standards for Advanced Inverter Capabilities (David Bassett, Consultant)
- Advanced Grid Integration Features, (Carl Lennox, SunPower Corporation)
- Moderated Discussion

Concluding Discussion

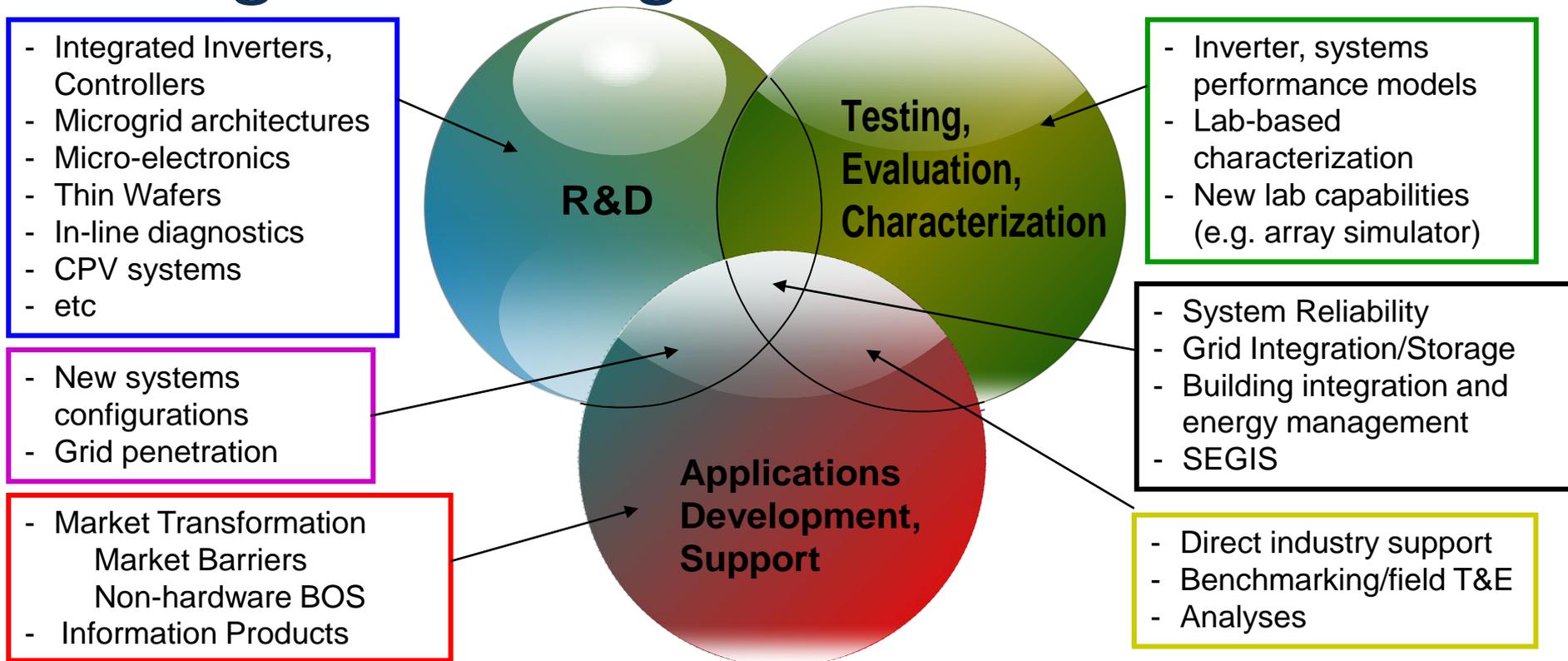
(Co-moderated by Hill and Coddington)

- Remaining Issues
- Desired Outcomes
- Recommendations
- Actionable items

Technical Issues Identified in FERC Proceedings

- On February 16 SEIA petitioned FERC for a rulemaking
- The PV market has made great progress with many thousands of systems installed
- The issues are not necessarily new but with increased system penetration they become more pronounced
- The DOE program has been working on the issues
- On July 17, FERC held a technical conference

Sandia's Photovoltaics and Grid Integration Program Areas

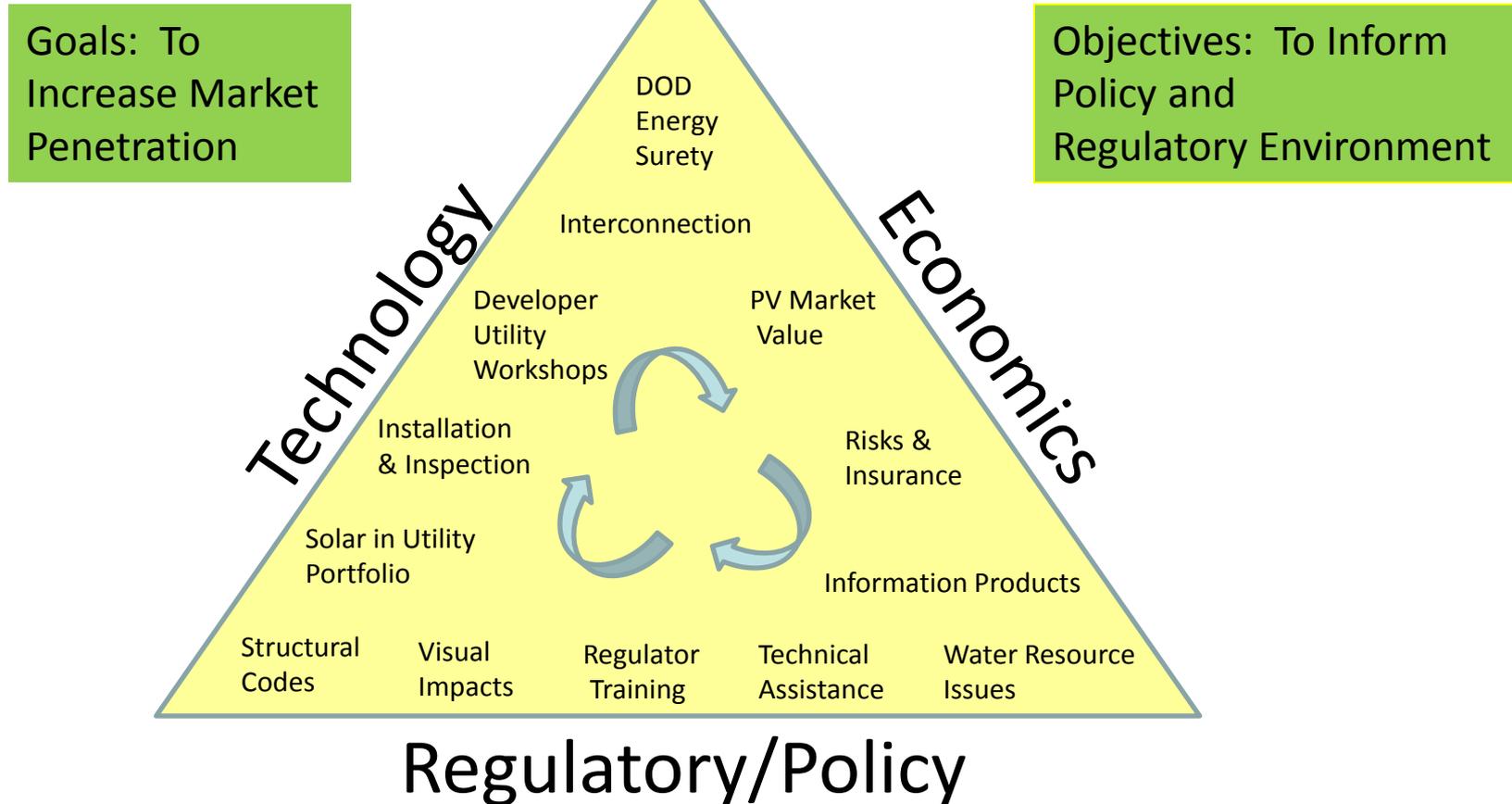


www.sandia.gov/pv publications

Market Transformation

-Soft Costs

Market Transformation promotes the commercialization of solar technologies by addressing non-technical issues that act as barriers to the adoption of solar energy technologies. The Market Transformation effort identifies and prioritizes significant barriers beyond traditional "cost" issues and develops specific activities and external partnerships to address those barriers.



Technical Issues Identified

- There is a need for transparent rules, provide a clear predictable path to interconnection for DG
- “Difficult to obtain, let alone understand, the rigorous technical justification for 1. Certain per-circuit limits, 2. Process and timeline for processing interconnection studies, and basis for interconnection upgrade requirements mandated by individual utilities, a gap in the regulatory system.”

Technical Issues Identified

- The 15% rule is overly conservative
- 100% of minimum daytime load
- Transmission providers must make peak and minimum load data available
- Increase size threshold for fast track from 2 MW to 10 MW
- Expedited review by third party experts

Technical Issues Identified

- Large numbers of installations is proof changes not needed, not a barrier
- Need for modeling, standard load profiles, minimum load data , transfer to smart metering, and smart grid, comparable access to basic information for wholesale market access
- Include CA settlement test-- CA Settlement includes Supplemental review that includes a Penetration Test, Power Quality and Voltage Fluctuation test, and safety and reliability test as part of a supplemental review

Technical Issues Identified

- Variable operations of solar
- NARUC --maintain state jurisdiction, takes costs and resources for minimum load data
- Don't wait for IEEE standards to address interconnection issues
- Queuing as an issue
- PGE advises caps by voltage of lines rough estimate of 15% applied

Technical Issues Identified in FERC Proceedings

- Rural areas less robust grid
- Technical conference
- Pre-application process
- Transactional costs
- Varying line capacity by differing voltages

Other Technical Issues

- Distribution automation
- Load switching
- Flicker
- Static system voltage levels
- Utility system protection
- Islanding detection
- Fault current contribution
- Voltage and current harmonic distortion issues,
- Stability issues
- Automatic transfer
- Customer owned transformer design