



U.S. Department of Energy
Office of Electricity Delivery & Energy Reliability

Electric Distribution



FY06 Annual Program and Peer Review Meeting

San Ramon, California
May 25-26, 2006

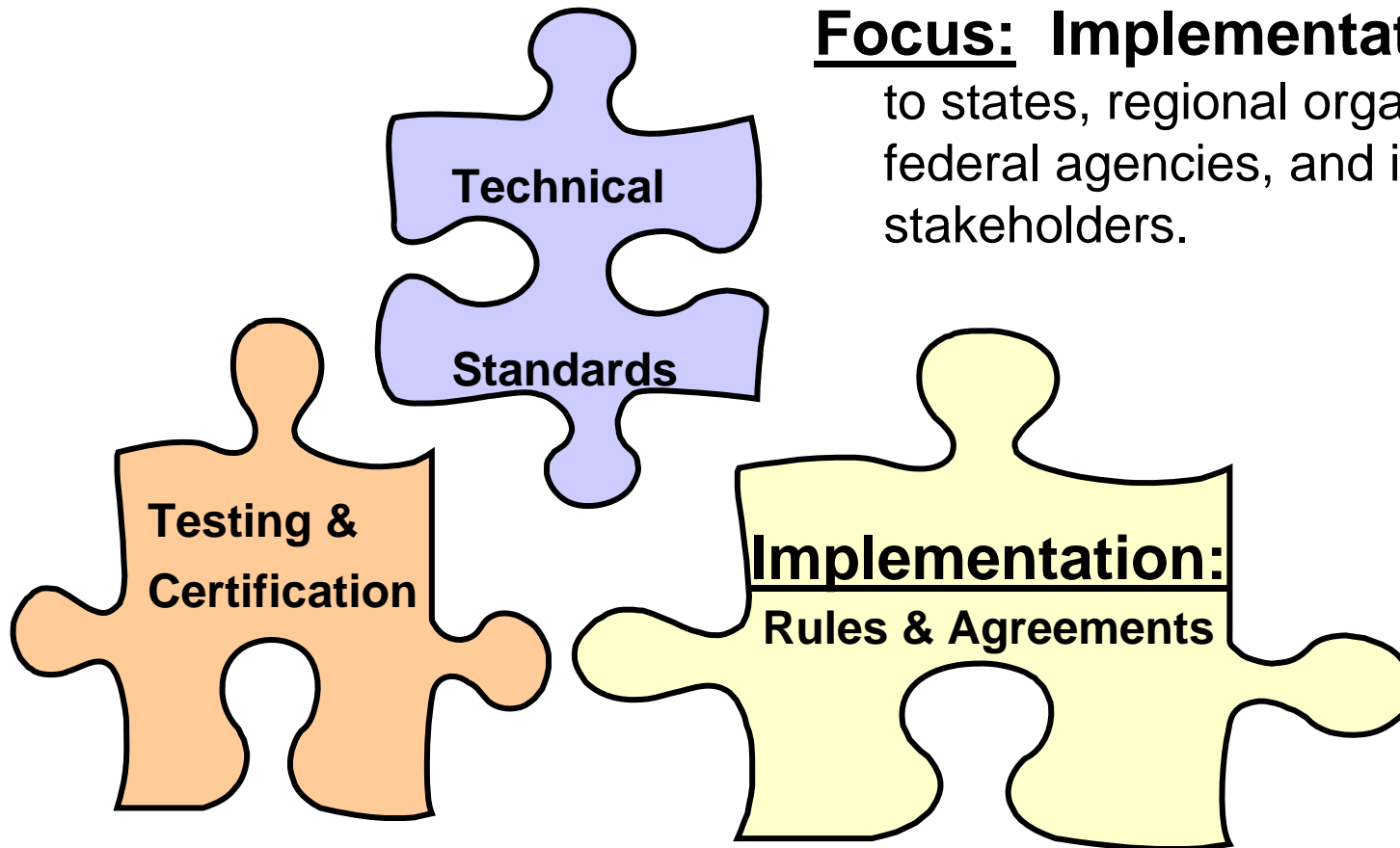
Regional Implementation of IEEE 1547

Brad Johnson - ACN Energy Ventures* and
Tom Basso – NREL

May 26, 2006

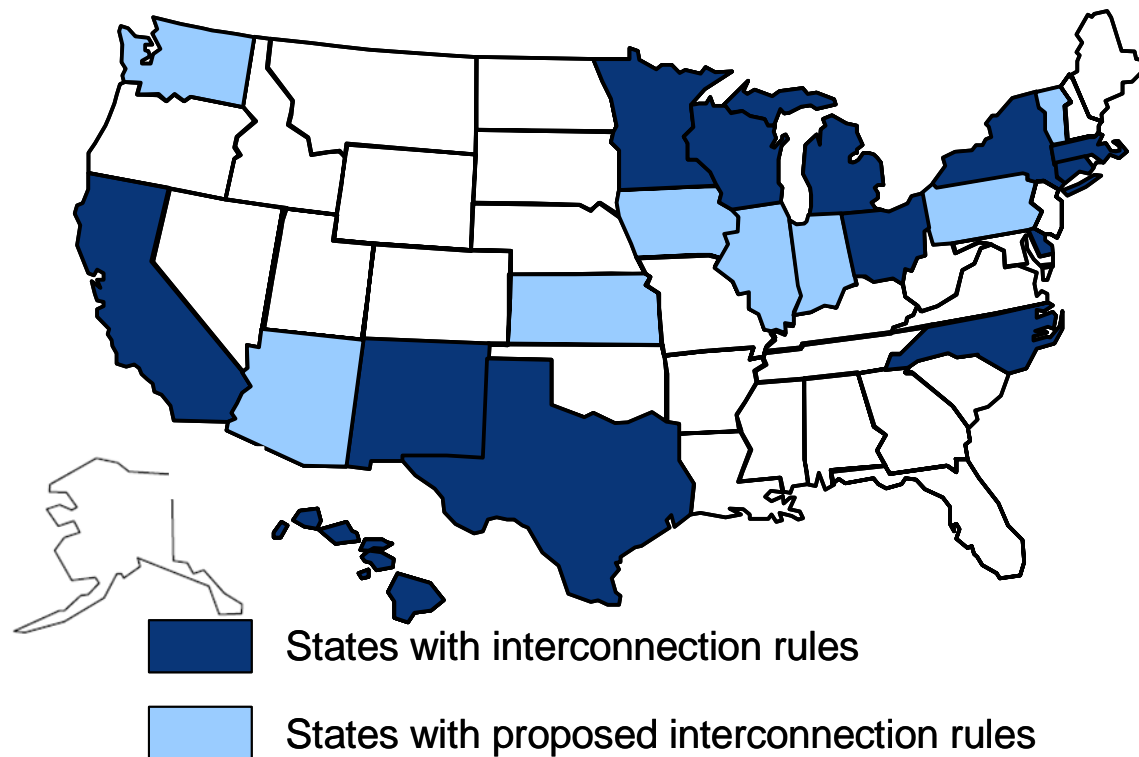
* NREL contract 66129-01

Interconnection Implementation: *Putting the Pieces Together*



Focus: Implementation support
to states, regional organizations,
federal agencies, and interconnection
stakeholders.

States with Interconnection Mandates (prior to 2005 EPACT)



Note: FERC and RTOs/ISOs, are also considering interconnection.

States assisted in 2005-2006:

AZ, CO, DC, DE, FL, GA, IN, IL, MD, MI, MT, OH, OR, PA, NJ, NM, WA

Lack of Consistent Implementation Approach By States Can Be a Barrier

- States individually implementing approaches
- Until recently, no mandate for uniform implementation -- Federal 2005 EPACT *Sec 1254 Interconnection*: utilities required to consider IEEE 1547, and promote agreements/procedures via current best practices
- Different ways of implementing IEEE 1547
- How to ensure validity, quality and consistency?
 - Incorporate or Mandate 1547 Standard?
 - Certification of Equipment?
 - Standardized Interconnection Rules/Procedures?

Utility Interconnection Practices Can Also Be a Barrier for DG

PJM/NREL Audit Results

(*Blue Font underlined indicates IEEE 1547 requirements that may be pre-certified)		
IEEE Std 1547 Clause	IEEE Std 1547 Requirement	PJM/TO Std Requirement
4.1 General Requirements	(heading only)	N/A
4.1.1 Voltage Regulation	DR shall not actively regulate voltage; not cause the Area EPS voltage at other PCCs to go outside requirements of ANSI C84.1 Range A.	No
4.1.2 Integration with Area EPS grounding	Grounding scheme shall not cause overvoltages that exceed rating of the equipment connected to the Area EPS	No
	Shall not disrupt coordination of Area EPS ground fault protection	Yes
<u>4.1.3* Synchronization</u>	<u>Not cause Area EPS prevailing voltage at PCC to exceed +/- 5% fluctuation</u>	No
	<u>Shall meet clause 4.3.2 flicker requirements</u>	No
4.1.5 Inadvertent Energization of the Area EPS	Shall not energize a de-energized Area EPS	Yes
4.1.6 Monitoring	Aggregate gen > 250 kva shall have provisions for monitoring (connection status, KW, KVAR, & voltage) at the DR connection	Yes, but size varies (often more data required by TO)
4.1.7* Isolation Device	When required by TO, shall provide readily accessible, lockable, visible-break isolation device	Yes
<u>4.1.8 Interconnect Integrity</u>	(heading only)	N/A
<u>4.1.8.1* EMI</u>	<u>EMI withstand shall meet C37.90.2</u>	No
<u>4.1.8.2* Surge Withstand</u>	<u>Shall meet C62.41.2 or C37.90.1 V&I withstand capability</u>	No
<u>4.1.8.3* Paralleling Device</u>	<u>Shall be capable of withstanding 220% of system rated V</u>	No
4.1.4 DR on distribution secondary grid and spot networks. (heading only)		N/A
4.1.4.1 Distribution secondary grid networks. (Under consideration for future revisions of std.		No
4.1.4.2 Distribution secondary spot networks (multiple requirements in 1547)		No

Summary Conclusions

- Requirements vary from utility to utility
- Requirements not transparent
- Requirements not uniformly applied
- Many additional requirements – probably not necessary

Jurisdictional Issues Between States & FERC Are A Complicating Factor

- FERC Has Jurisdiction for DG That Participates in Wholesale Markets (Even if it Interconnects at Distribution Level)
- All Retail Interconnections Fall Under Jurisdiction of State PUCs, e.g. Net Metering
- Ideally, Wholesale and Retail Interconnection Requirements Should Be Similar

DOE IEEE 1547 Implementation Efforts Started in January 2004

*Goal: Implement Consistent Small
Generator Interconnection Procedures,
Based on IEEE 1547, That Are
Consistent for Wholesale and Retail
Interconnections Across
Multi-State Geographic Regions*

Implementation Strategy

- Work With ISOs (PJM and MISO) To Get Utilities to Adopt Interconnection **Technical Requirements** Based on IEEE 1547
- Work With Regional State Organizations (MADRI and OMS) To Develop Model Small Generator **Interconnection Procedures** for States To Consider
- Work with individual states toward uniformity and transparency
- Support satisfying 2005 EPACT

PJM Interconnect* Small Generator Std

(2 MW Std Approved by FERC in 2005)

- Two Major Goals**
 - Standardize interconnection requirements, based on IEEE 1547, throughout PJM business domain
 - Ensure test compliance to IEEE 1547
- PJM standard allows pre-certification
- PJM expanding std to 10 MW, then 20 MW

* PJM Interconnect (in yellow) is a Regional Transmission Organization (RTO) with over 180 GW load

** Technical Support by DOE/NREL

PJM Progress Report – 2 To 10 MW Technical Requirements

- Approved by Stakeholder Group in Late 2005 Subject to Further Testing of Monitoring Provisions (FERC approval may not be required)
- Proposed Monitoring Provisions Call for PJM to Install a Low Cost SCADA System on Small Generators
- Utilities Access Generator Data Through PJM
- Ensures Consistent Monitoring Requirements Throughout PJM and Provides Greater Certainty to Developer Regarding Monitoring Requirements and Cost

PJM Progress Report – 10 To 20 MW Technical Requirements

- PJM Stakeholder Group Began Consideration of 10-20 MW Technical Requirements in January of 2006
- Goes Beyond IEEE 1547 Which Covers Projects Up to 10 MW; However, Both FERC and PJM Small Generator Interconnection Procedures Include Projects Up to 20 MW

MADRI Model Interconnection Procedures Approved Nov '05

Mid-Atlantic Distributed Resources Initiative

Interconnection Task

Foster regional consistency among states' small generator interconnection procedures across Mid-Atlantic region: DC, DE, MD, NJ, PA.

Key Considerations

- Establish common technical standards requirements
- Establish model implementation procedures, rules and agreements

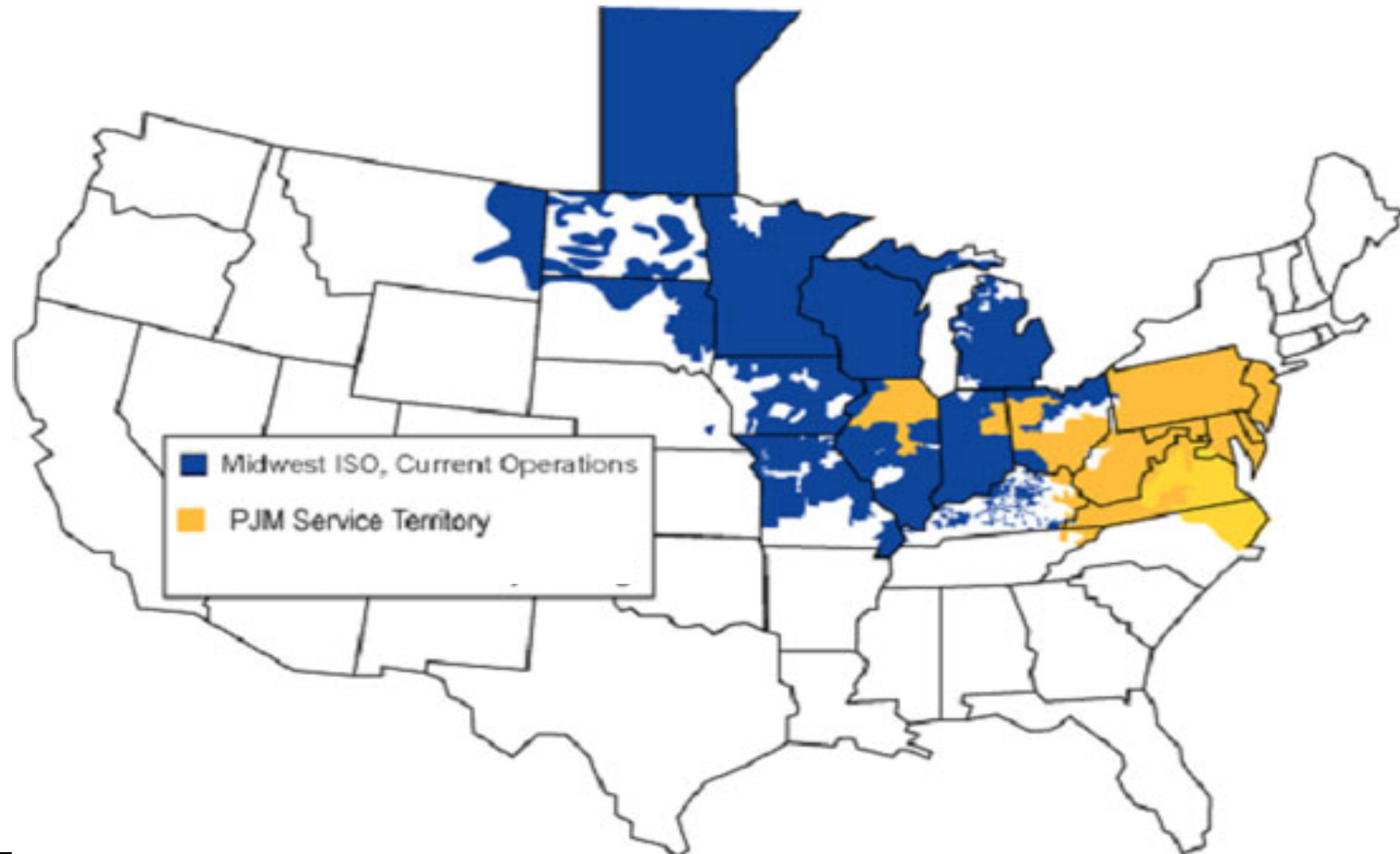
Implementation Progress In MADRI States

- *Pennsylvania Interconnection Rulemaking (0-2MW) Issued 11/05 Based on MADRI*
- *Maryland Interconnection Proceeding Opened on 04/06 Based on MADRI*
- *New Jersey Side-By-Side Showed High Degree Of Similarity Between NJ Standards & MADRI*
- *District of Columbia – Plans to Open Interconnection Proceeding Based on MADRI Procedures in 2006*
- *Delaware – Interconnection Plans Are Uncertain; Focused on Resolving Issues Related to 59% Increase In Residential Rates*

Progress Report – OMS & MISO

- Organization of MISO States (OMS) Is Considering A Role Similar to What MADRI Played to Coordinate Development of Model State Interconnection Procedures for States to Consider
- Midwest ISO (MISO) is Contemplating a Role Similar to What PJM Played to Coordinate Development of Technical Requirements
- Next Step is Midwest Stakeholder Workshop in June/July Timeframe

Potential For Regional Implementation Strategy



What's Next – FY 2007 Plan

- Finalize MISO/OMS Activity
- Harmonize PJM & MISO Interconnection Standards In States That Belong to Both ISOs
- Take Advantage of Window of Opportunity
– Support States in Meeting Their EPACT Interconnection Requirements
- Continue to Pursue Regional Implementation Opportunities

Budget

- FY 2005
 - Subcontracts: \$98,000
 - NREL In House: \$200,000
- FY 2006
 - Subcontracts: \$110,500
 - NREL In House: \$239,500
- FY 2007 To Be Determined

Cost sharing: all partners/collaborators fully pay their own cost for participating.

Interactions and Collaborations

- ISOs – PJM & MISO
- State Regional Organizations – MADRI & OMS
- Various State Agencies, e.g. Public Utility Commissions, State Energy Offices
- DG Stakeholders, e.g. Advocates, DG Developers
- Other Federal Agencies – FERC, EPA
- NCEP - National Council for Electricity Policy
ncouncil.org - a joint venture among the National Conference of State Legislatures (NCSL), the National Association of Regulatory Utility Commissioners (NARUC), the National Association of State Energy Officials (NASEO), and the National Governor's Association (NGA).

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1617 Cole Blvd. MS-1614 Golden, CO 80401-3393
- **IEEE Std 1547 Series of Interconnection Standards --**
http://grouper.ieee.org/groups/scc21/dr_shared/