



Distributed Generation Interconnection Rules

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Purpose

- Provide an overview of state rules and national efforts to develop and implement uniform distributed generation interconnection requirements

Outline

- Overview
- State Rules
 - Wisconsin
 - Minnesota
- National Efforts
 - NARUC
 - IEEE
 - FERC

Overview

- General Goals for DG Rules:
 - Provide cost savings and reliability benefits to electric customers
 - Encourage construction of economic and efficient alternative generating sources
 - Establish uniform terms and conditions for DG interconnection

Overview

■ Key Questions:

□ Cost responsibility:

- Studies
- Interconnection

□ Jurisdiction:

- Who has jurisdiction over installations?
(State Commission, FERC, RTO/ISO)

□ Mandatory requirements versus standards

State Rules

- Wisconsin
- Minnesota



Wisconsin DG Rules

Wisconsin DG Rules

- Wisconsin Administrative Code
 - Chapter PSC 119
- Subchapter I – General
 - Scope
 - DG facilities ≤ 15 MW
 - Rules establish uniform statewide standards for DG interconnection to an electric distribution system
 - Definitions
 - Category 1 ≤ 20 kW
 - Category 2 > 20 kW and ≤ 200 kW
 - Category 3 > 200 kW and ≤ 1 MW
 - Category 4 > 1 MW and ≤ 15 MW

Wisconsin DG Rules

- Subchapter II – General Requirements
 - Designated point of contact
 - Application process for interconnection of DG facilities
 - Describes steps and give response times for various DG “categories”
 - Insurance and indemnification (minimums)
 - Category 1- \$300,000
 - Category 2- \$1,000,000
 - Category 3- \$2,000,000
 - Category 4- Negotiated

Wisconsin DG Rules

- Subchapter II – General Requirements
 - Modifications to the DG facility
 - Easements and rights-of-way
 - Fees and distribution system costs
 - Disconnection
 - One-line schematic diagram
 - Control schematics
 - Site Plan

Wisconsin DG Rules

- Subchapter III – Design Requirements
 - General design requirements
 - Minimum protection requirements
- Subchapter IV – Equipment Certification
 - Certified paralleling equipment
 - Non-certified paralleling equipment

Wisconsin DG Rules

- Subchapter V – Testing of DG Facility Installations
 - Anti-islanding test
 - Commission test for paralleling equipment in categories 2 to 4
 - Additional test
 - Right to appeal



Wisconsin Interconnection Collaborative

- Group of interested parties that developed (through consensus) interconnection guidelines that formed the basis for Wisconsin DG Rules
 - Provides guidance in applying Chapter 119

Wisconsin Interconnection Collaborative

- Information not specifically detailed in Chapter 119
 - Applicant responsibilities
 - Agreements
 - DG Facility Operations Manual
 - DG Facility Maintenance Records
 - Interconnection to transmission system
 - Revenue Metering Requirements

Wisconsin Interconnection Collaborative

■ Appendices

- Glossary
- Protection System Functions
- Operating Limits, Power Quality, and Standards Summary
- Codes and Standards
- Standard Application (Category 1)
- Sample One Line Diagram (Category 1)
- Standard Application (Category 2 – 4)
- Sample One Line Diagram (Category 2 – 4)
- Standard Interconnection Agreement (Category 1)
- Standard Interconnection Agreement (Category 2- 4)⁵



Minnesota Generic DG Process



Outline

- MN Legislative & Regulatory Overview
- Interconnection Issues
- Rate Issues
- Next Steps

MN Energy Security and Reliability Act (2001)

- The Act includes provisions for:
 - Public building energy conservation
 - Joint ventures
 - DG Interconnection and tariffs
 - Consumer protection
 - Renewable incentive payments
 - Distribution reliability
 - Siting and routing of power plants and transmission lines
 - Renewable energy and conservation

Article 3 - DG Interconnection & Tariffs

- Legislative Purpose of Article 3:
 - Establish terms and conditions for interconnection and operation of DG
 - Provide cost savings and reliability benefits to customers
 - Establish technical requirements to promote safe and reliable operation of DG
 - Enhance reliability and economic efficiency in the production and consumption of electricity
 - Promote DG to provide system benefits during periods of capacity constraints



Interconnection Standards: Legislative Guidance

- Requires MPUC proceeding to establish generic standards
- Interconnection and operation of DG fueled by natural gas or a renewable fuel
- 10 MW or less

Interconnection Standards: Legislative Guidance (Continued)

- Generic standards must at least:
 - Be consistent with industry, federal, and state operational and safety standards
 - Provide low cost, safe, and standardized interconnection of facilities
 - Recognize differing system requirements, hardware and overall demand load requirements
 - Allow for reasonable terms and conditions to assure reliable, safe, and efficient operation
 - Establish a standard application and agreement/contract

MPUC Establishment of Generic Standards

- MPUC Process - “first step”
 - Order issued August 20, 2001
 - File comments and proposals by 12/3/01
 - Reply comments and proposals by 1/18/02
- MPUC Meeting
 - April 25, 2002 MPUC agenda meeting
 - June 19, 2002 Order requires establishment of Work Groups

More Process

- Work Groups
 - Technical
 - Rates
- Filings to MPUC
- Report submitted February 3, 2003
 - Comments March 21, 2003
 - Reply Comments June 27, 2003
- Phase II Report (Technical Issues) submitted May 22, 2003
 - Comments July 15, 2003
 - Reply Comments July 29, 2003



Technical Work Group

- Goals
- Documents
- Issues

Political Goals

- Achieving uniformity in installation design
- Avoiding obstacles for installers
 - Avoid each utility doing it different
- Overall reduce installation costs

Goals of Interconnection Requirements / Standards

■ SAFETY

- Utility personnel and contractors working on Electric Power System (EPS)
- Customers and general public
- Protect and minimize damage to EPS and other customer's property
- Ensure proper operation to minimize adverse operating conditions on the EPS



Documents

- Interconnection Process
- DG Interconnection Requirements
- Application
- Engineering Data Submittal
- Agreement

Interconnection Process

- Overview / Background for customer
- Process steps:
 - Application
 - Preliminary Review
 - Go – No Go Decision
 - Engineering Studies
 - Study Results and Construction Estimates
 - Final Go – No Go Decision
 - Final Design Review
 - Order Equipment and Construction
 - Final Tests

DG Interconnection Requirements

- The Technical Document
- Table of Contents:
 - Introduction
 - References
 - Types of Interconnections
 - Interconnection Issues and Technical Requirements
 - Metering, Monitoring and Control
 - Protective Devices and Systems
 - Agreements
 - Testing Requirements

Application

- Used for preliminary review
- Information:
 - Name / Address
 - Location of Generator
 - Project Design / Engineer
 - Electrical Contractor
 - Generator Specs (general)
 - Type of Interconnected Operation

Engineering Data Submittal

- Used for final review
- Information:
 - Application information PLUS
 - O&M contact information
 - System operating information
 - Construction start / completion dates
 - Generator Specs (more detailed)
 - Transfer Switch
 - Inverter
 - Power circuit breaker

Agreement

- Contract
- Sections include:
 - Scope and Purpose
 - Definitions
 - Description of DG System
 - Responsibilities of Parties
 - Construction
 - Documents included with the Agreement
 - Terms and Termination
 - Operational Issues
 - Limitation of Liability
 - Dispute Resolution
 - Insurance
 - Miscellaneous



Issues Not Resolved

- Insurance
- Utility Response Times
- Developer Cost
- Standard Operation and Maintenance

Insurance

- Utility Minimums

- DG > 250 kW = \$2 million

- Between 40 kW & 250 kW = \$1 million

- DG < 40 kW = \$300,000

- Other interested parties believe these levels are too high

Utility Response Times

- Developers are concerned about unspecified time frames
 - Need parameters or benchmarks
- Utilities note that variety and complexity of projects justifies flexibility

Developer Cost

- Developers are concerned that flexible engineering times lead to uncertain costs
 - Want standardized costs similar to application fees
- Utilities say flat fee may work for small projects but is problematic for large installations

Standard Operation & Maintenance

- Several parties want standard O&M requirements
- Utilities say that since interconnections will be unique this requires unique O&M agreements
 - General content guidelines are provided

Rate Issues

- Availability
- Qualifications
 - Ownership
 - “Must Buy”
 - Customer Options
 - Transactions outside the tariff

Rate Issues (Continued)

- Supply Service
 - Energy and Capacity
 - Scheduled Maintenance
 - Unscheduled Outages
 - Supplemental Service

Rate Issues (Continued)

- Rate Principle – Services from DG Customer to Utility:

Rates should reflect the value of the distributed generation to the utility, including any reasonable credits for emissions or for costs avoided on the generation, transmission and/or distribution system.

Rate Issues (Continued)

- Rate Principle – Energy and Capacity Purchased from DG and Services Provided by Utility to DG Customer:

Rate should reflect the costs the utility expects to avoid. To the extent practical, these costs should reflect seasonal and peak/off-peak differences in costs.

Rate Issues (Continued)

- Calculation of Avoided Costs

- Avoided Energy Costs

- Average monthly on-peak and off-peak marginal costs

- Avoided Capacity Costs

- Levelized Annual Revenue Requirement for next unit

Rate Issues (Continued)

■ Standby Rates

- Firm Service

- Non-Firm Service

- Physical Assurance

- ≤ 100 kW exempt from standby charges

Rate Issues (Continued)

■ Credits

- Distribution

 - Area or site specific

- Diversity = NO

- Line Loss = NO or MAYBE

- Renewable = MAYBE

- Emissions = In Dispute

- Reliability = NO



Next Steps

- MPUC
- Regulated Utilities
- Municipals

MPUC Next Steps

- MPUC Meeting and Decision on Generic Standards
 - Official order follows decision

Regulated Utilities

- Regulated Utilities have 90 days from date of MPUC Order on generic standards to file tariffs
- DOC and any other interested party can file comments within 30 days
 - 30 day comment period will likely be extended
- Then file Reply Comments
- Schedule MPUC agenda meeting to decide on tariffs
- Implement Tariffs

Action Items for Munis & Co-ops

- Review and reach consensus on Technical Requirements and Documents
 - As similar as possible to MPUC generic standards and regulated utilities
 - Consistency among utilities
- Consider wholesale services and rates applicable to DG
- Be ready to respond with retail rates



NARUC

NARUC

- National Association of Regulatory Utility Commissioners
 - Association of state PUC / PSC
 - Committees and sub-committees develop background information – and in some cases positions – on matters of state regulatory interest
 - Periodic meetings and conventions
 - Publications

DG at NARUC

- Model Distributed Generation Interconnection Procedures and Agreement (July 2002)
- Model Interconnection Procedures and Agreement for Small Distributed Generation Resources (October 2003)

NARUC Model

- Intended to be a resource for state commissions
 - Not intended as “preferences” but to provide “information”
- Light bulb symbols indicate where a range of choices is possible for a regulatory decision



NARUC Model

- Model Interconnection Procedures
- Agreement
- Ranges for State Variables

NARUC Model

- Model Interconnection Procedures
 - Scope and Purpose
 - Eligibility
 - Timelines
 - Company Responsibilities
 - Definitions
 - Interconnection Review Process

NARUC Model

- Model Interconnection Procedures
 - Pre-Application Communication
 - Completed Application Provided
 - Company Review of Application
 - Fast Track Review
 - Standard Review
 - Interconnection Agreement
 - Project Construction
 - Connection, Testing, Operation

NARUC Model

- Model Interconnection Procedures
 - Dispute Resolution Procedures
 - Pre-Certification Testing
 - Technical Requirements

NARUC Model

- Agreement (contract)
 - Scope and Purpose of Agreement
 - Summary and Description of Customer's DG Equipment/Facility
 - Responsibilities of Utility and Customer
 - Prior Authorization
 - Warranty is Neither Expressed Nor Implied
 - Liability Provisions
 - Limitation of Liability
 - Indemnification
 - Force Majeure

NARUC Model

- Agreement (contract)

- Insurance

- Effect

- Severability

- Notices

- Right of Access

- Disconnection of Unit

- Effective Term and Termination Rights

NARUC Model

- Agreement (contract)
 - Governing Law
 - Assignments
 - Confidentiality
 - Dispute Resolution
 - Amendment and Notification
 - Entire Agreement
 - Non-Waiver
 - No Third Party Beneficiaries

NARUC Model

- Ranges for State Variables
- Policy Light Bulbs:
 - Cost Responsibility for Fees
 - Time Frame for Company Review
 - Time Frame for Fast Track
 - Study Time Frame for Radial/Network Review
 - Requirements for Electrical Schematic Drawings
 - Time Frame for Letter of Acceptance
 - Dispute Resolution Procedures

NARUC Model

- Ranges for State Variables
- Technical Light Bulbs:
 - Size Requirement of New DG Facility
 - Pre-Certification Testing
 - Factors that Qualify or Disqualify DG for Fast-Track Review Process
 - Technical Requirements Issues
 - Fast Track Application
 - Standard Application



IEEE

IEEE

- Institute of Electrical and Electronics Engineers
 - Global standards-setting body
 - Develops consensus standards through an open process
 - Conferences
 - Publish Standards

DG at IEEE

- Use of decentralized DR is expected to make overall EPS more flexible and secure
- DR may also:
 - Lower cost of electricity
 - Make electrical generation cleaner and more efficient
 - Reduce transmission and distribution line loss and congestion
 - Improve power reliability and quality

DG at IEEE

- IEEE 1547, “Standard for Interconnecting Distributed Resources with Electric Power Systems”
 - Sets technical requirements for interconnecting electric power systems with fuel cells, photovoltaics, microturbines and other local generators
 - Approved July 2003

DG at IEEE

- IEEE 1547, “Standard for Interconnecting Distributed Resources with Electric Power Systems”
 - Addresses:
 - Performance
 - Operation
 - Testing
 - Safety

DG at IEEE

- IEEE 1547, “Standard for Interconnecting Distributed Resources with Electric Power Systems”
 - The standard’s criteria and resources also address:
 - Product Quality
 - Interoperability
 - Design
 - Engineering
 - Installation
 - Certification

DG at IEEE

- IEEE is the first in a “family” of standards for DR.
- Other standards currently underway:
 - IEEE P1547.1™ - Test Procedures
 - IEEE P1547.2™ - Technical background and application details for various DR technologies
 - IEEE P1547.3™ - Guidelines for interoperability

DG at IEEE

IEEE SCC21 1547 Series of Interconnection Standards

IEEE 1547™ (2003) Standard for Interconnecting Distributed Resources With Electric Power Systems

Guide for Networks

Guide for Impacts

P1547.3

Draft Guide for Monitoring, Information Exchange, and Control of DR Interconnected With EPS

P1547.4 Draft Guide for Design, Operation, and Integration of Distributed Resource Island Systems With Electric Power Systems

Guide For Interconnection System Certification

P1547.2

Draft Application Guide for IEEE P1547 Draft Standard for Interconnecting Distributed Resources With Electric Power Systems

P1547.1

Draft Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources With Electric Power Systems

DP Specifications and Performance (includes modeling)

The above identifies existing IEEE SCC21 standards development projects (1547 series) and activities under discussion by SCC21 Work Group members.



FERC

FERC

- Federal Energy Regulatory Commission
 - Part of the US Department of Energy
 - Regulate wholesale power transactions and interstate commerce over transmission lines

DG at FERC

- Standardized Proposed Interconnection Rule for Small Generators
 - FERC Docket No. RM02-12-000
- Standardized Large Generator Interconnection Final Rule
 - FERC Docket No. RM02-1-000

DG at FERC

■ Purpose of Proposed Rules:

- Reduce cost of electricity to customers
- Encourage development of alternative sources of generation
- Expedite development of new generation infrastructure
- Reduce time and cost to interconnect
- Limit opportunities for transmission providers to favor their own generation
- Preserve reliability and safety of the transmission provider's transmission system

DG at FERC

■ Applicability:

- Small generators ≤ 20 MW
- Large generators > 20 MW
- Applies to 176 IOUs that own, control, or operate interstate transmission facilities
- Applies to facilities subject to transmission provider's OATT at the time an interconnection request is made
- Does not affect existing interconnection agreements
- OATT must be modified to incorporate standard interconnection procedures and agreement

DG at FERC

■ How Rule Benefits Generators:

- One set of standardized interconnection procedures and agreement throughout the nation should reduce costs and time involved to interconnect
- Legal obligations and rights of all parties are clearly set out
- Generator access to databases allows for independent studies rather than relying on the transmission provider
- Super Expedited, Expedited, and Accelerated procedures facilitate rapid interconnection
- NARUC model will help state commissions where they oversee small generator interconnections

DG at FERC

- How Rules Benefit Transmission Providers:
 - Standardized procedures and agreements streamline interconnection process, saving time and money
 - Reduce burden of negotiating arrangements with generators on a case by case basis
 - Clustering of interconnection studies provides more efficient study of groups of interconnection applicants
 - Requiring a generator to achieve commercial operation before it can receive a refund for construction costs helps ensure that transmission upgrades are done only for serious interconnection projects

DG at FERC

- Generator Interconnection Pricing:
 - Generator pays for facilities on its side of the point of interconnection
 - Cost of transmission upgrades to accommodate the new generator is initially funded by the generator
 - Amount paid by the generator is refunded during the 5 years following commercial operation of the generator
 - Cost of upgrades to the transmission providers jurisdictional distribution system to accommodate the new generator is paid entirely by the generator

DG at FERC

- Generator Interconnection Pricing:
 - Permits pricing flexibility for a RTO or ISO, including the use of participant funding
 - Public Utilities may propose regional variations to the rule if:
 - The variations are consistently used by all utilities in the region; and
 - It is demonstrated that the variations are consistent with or superior to the provisions of the rule

DG at FERC

- Key Question: Jurisdiction
- Where is jurisdictional boundary between FERC and state commissions?

Conclusion

- There appears to be general consistency among:
 - Standards
 - State Rules
 - Federal Rules
- Some details need to be resolved
- Key question is jurisdiction / authority over installations

Conclusion

- PURPA requirements remain in effect
- Communication is important:
 - Customers
 - Other utilities
 - Regulators
- Consistency among utilities is vital

References

- **NARUC** (National Association of Regulatory Utility Commissioners)
<http://www.naruc.org>
- **IEEE** (Institute of Electrical and Electronics Engineers)
<http://www.ieee.org>
- **FERC** (Federal Energy Regulatory Commission)
<http://www.ferc.gov>
- **NRRI** (National Regulatory Research Institute)
<http://www.nrri.ohio state.edu>
- **Wisconsin**
<http://psc.wi.gov>
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Questions / Discussion