

Distributed Generation Technical Issues and the Role of Standards

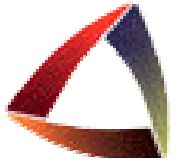
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Outline

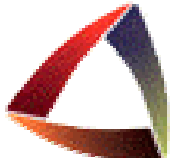


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- Main Technical Issues
- Types of generation
- Role of Standards
- Documents available or under development.



Quality of Supply

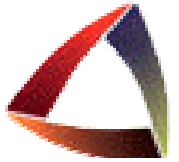


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- Voltage Regulation
- Flicker
- Harmonic Voltages
- DC injection



Protection

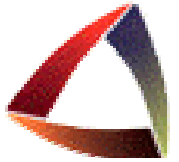


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- of Generator....Dependent on
 - Type of generator
- of Network.....Dependent on:
 - Level of risk
 - Position in network
 - Power
 - System impedance
 - Types of generators & their connection arrangements



Others

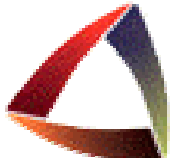


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- Synchronisation
- Disconnect / re-connect requirements
- UPS/Islanding allowed?
- Reactive power management/generation
- Metering
- Reliability



Types of Generation

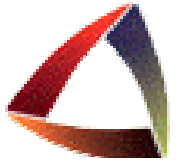


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- Asynchronous
 - Closing Currents
 - Reactive power
 - Self excitation with Cs
 - Short transient response-low energy storage
- Synchronous
 - Synchronisation
 - Reactive power control
 - Islanding possible
 - Well known technology



Types of Generation



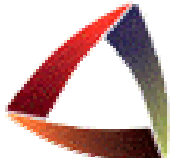
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- Power electronic Converter
 - Number of options
 - Line commutated
 - HF switched
 - Synchronisation
 - Harmonics
 - DC injection
 - VAr control
 - EMI – EMC
 - Fast response



Role of Standards

Experience with small systems



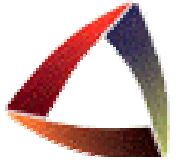
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- Driving forces
 - Problems with acceptance
 - Concerns of Utilities regarding safety and system issues.
- Steps:
 - Guidelines
 - increased acceptance
 - Lack of uniform acceptance
 - Regulators reluctant to call up a guideline.



Role of Standards

Experience with small systems



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- Steps continued:
 - Standard
 - Comprehensive and rigorous process
 - Stimulates comprehensive discussion of the issues.
 - Committee review
 - Industry consultation
 - Industry volte



Role of Standards

Experience with small systems

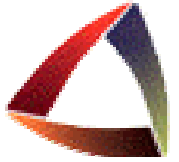


- **Result**
 - Standard gives a better comfort level & more uniform acceptance.
 - Allows regulator to call up the standard.
 - Avoids technical problems in implementing systems.
 - Uniform approach
 - All technical issues addressed
 - Reduces delays in implementing systems.



Role of Standards

Larger systems



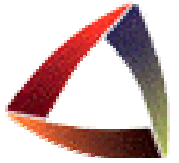
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- Standards approach probably a good one!
- Need an initial stage of:
 - Consultation
 - Scoping of document
 - Comprehensive research of technical issues
 - Drafting of document with considerable industry participation.
- Then Standards process.



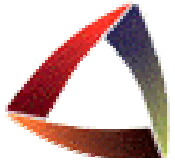
Role of Standards

Larger systems...BENEFITS



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- Standard process gives comprehensive peer review.
- Will allow regulator to call up the standard.
- Avoids technical problems in implementing systems.
 - Uniform approach
 - All technical issues addressed
- Reduces delays in implementing systems.



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A few useful documents

- AS4777 Inverter connection up to 30kVA
- EnergieNed, “Supplementary Conditions for Decentralised generators – Low-Voltage level” Nov 1997
- EnergieNed “Technical terms of connection to the public network for local production units” (MV & HV) Arnhem May 1994
- IEEE 1547
 - Up to 10MVA at PCC, radial distribution systems, Synchronous, Async & Inverters
- GEC Power Quality, Protection and Reliability Case Studies Report (DG) Sept 2001