Application Considerations
IEEE 1547-2018

Alaska Research Day

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IEEE Standard for…

Interconnecting Distributed Resources with Electric Power Systems *(2003)*

16 pp

Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces *(2018)*

124 pp

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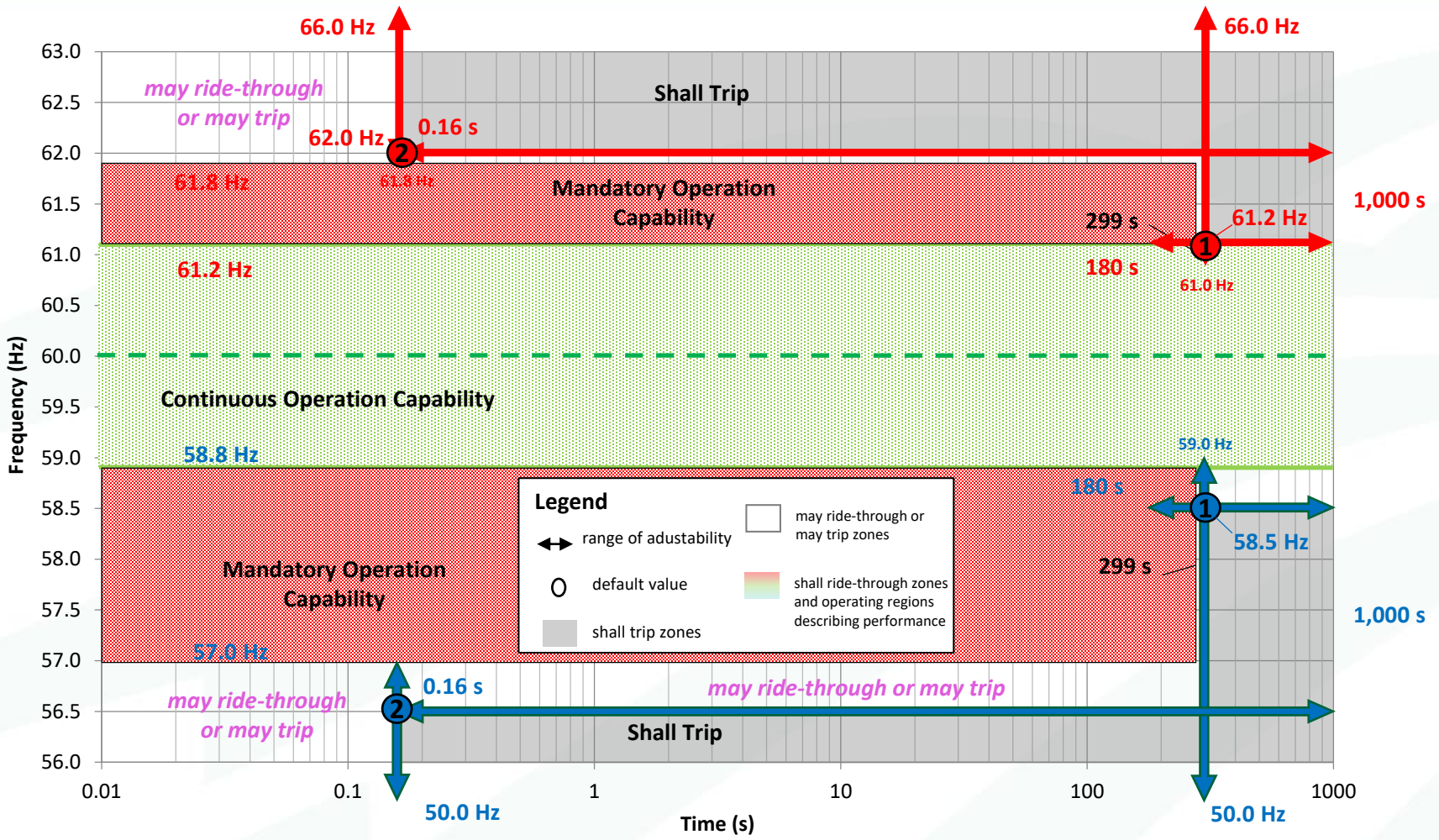
Voltage Disturbances
Frequency Disturbances

- NERC and a few utilities began to advocate **less-sensitive setpoints for tripping**:

  - ***Keep DERs On-Line for Disturbances on BES.***
  - Still enable tripping for ***Safety on Distribution Systems.***

- Reclosing also considered

Frequency Trip
New Standard (for Illustrative Purposes Only)



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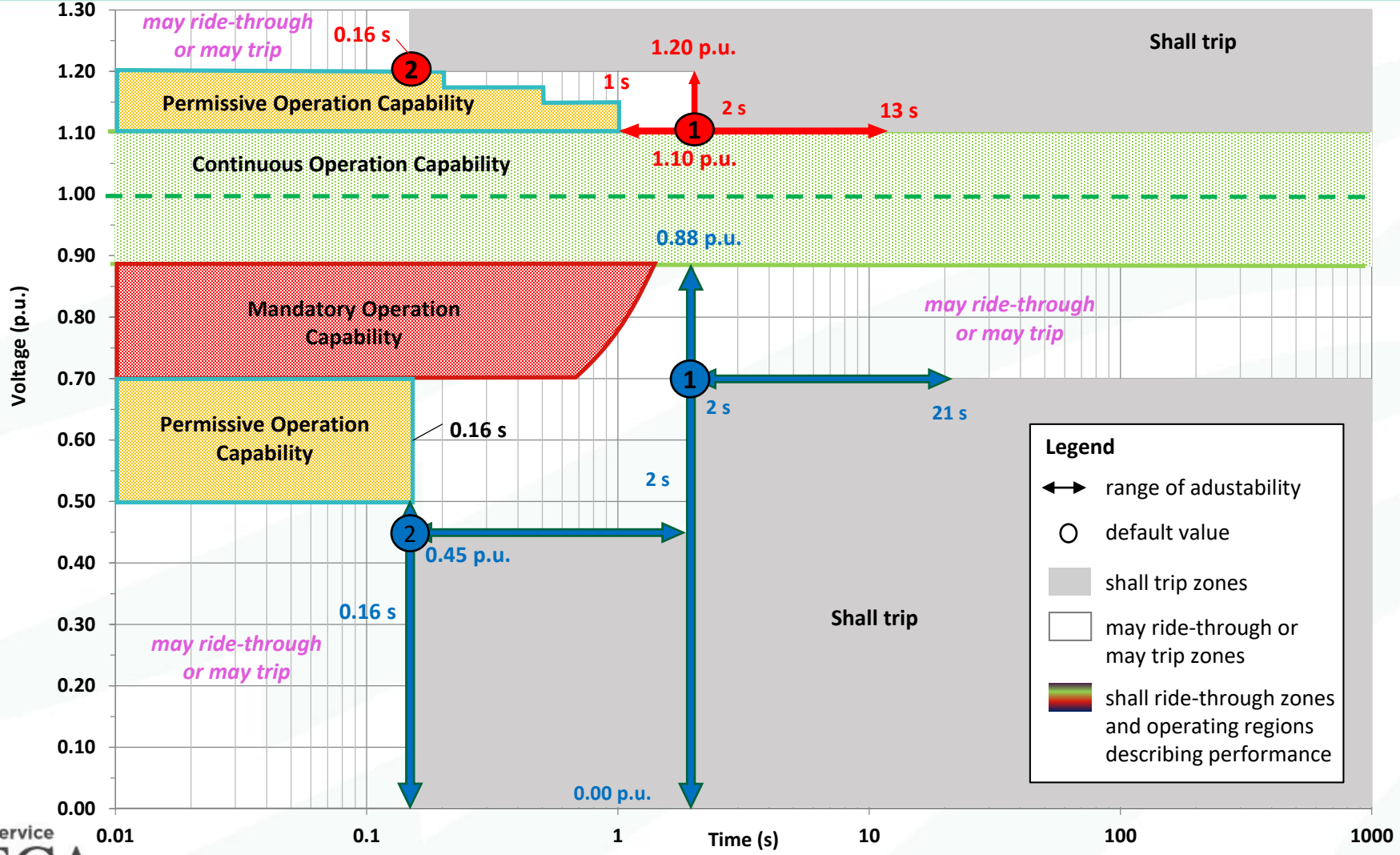
Voltage Trip

New Standard- Category I (for Illustrative Purposes Only)



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Vigilance on FRT & VRT

- Provide ***Settings*** to DER Owners\Installers.
- Commissioning ***Tests***.
- Periodic ***Retests*** *(maybe inspections)*.
- Interoperability- ***Alarms***.
- Education
  - Public
  - Installers

REMEMBER - ***Who Owns/Controls the Inverter?***

Category I, II and III

- **Cat I** Meets most BES Security needs. Includes small synchronous machines.
- **Cat II** *Harmonized w\NERC PRC-024* (protection settings for BES generators)
- **Cat III** High-Penetration levels where continued DER operation is needed for **Distribution System**. *Harmonized w\CA Rule 21*.

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Reclosing
Original Standard

- DER must “cease to energize the circuit” prior to reclosure (sec. 4.2.2).
- Must clear within 2s of event.
- Must ***not reconnect*** for ***up to 5 minutes*** after:
  - Voltage within Range B of ANSI C84.1, Table 1
  - Frequency within 59.3-60.5 Hz.

Reclosing
New Standard

- Allows ***reclosing*** into a line ***energized by DER***.
- Assumes means are employed to ***detect excessive differences***:
  - Phase angle
  - Voltage magnitude
  - Frequency
- Utility to employ Hot Line Blocking, Synch-Check, etc as needed.

Reactive Power and Voltage Regulation
New Standard

- Requires DER to be ***Capable*** of Regulating Voltage through Reactive Power Control.
- Prescribes Five Different Methods which DER must be capable of.
- ***Notes:***
  - Requirement of DER equipment manufacturers.
  - Settings are to be at ***sole discretion of Co-Op/Utility***.
  - Co-Op/Utility may also choose to ***not*** use this capability.

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Good News!

- Can help stabilize Voltage on Distribution circuits.
- Reduce wear on Voltage Regulators & LTCs.
- Can mitigate flicker and other voltage fluctuations.
- May reduce the need for reconductoring to offset effects of voltage swings.

Caution!
Law of Unintended Consequences

- ***Evaluate*** circuit & DER ***carefully*** to choose method and settings.
- As other DERs are added, may need to ***reevaluate*** original method & settings.
- Load increases, decreases or reconfiguration of circuit can all come into play.
- Any of these methods *may lead to power quality issues* if not closely managed.

Category A and B

- **Cat A** Meets VAR & Control requirements for all DER systems presently in use.
- **Cat B** Enhanced requirements which can benefit the power system, but which some DER systems may not meet.

AGIR
Authority Governing Interconnection Requirements

- Distinct from AHJ (Authority Having Jurisdiction)
- May be an ISO, PUC, Municipality, or Co-Op Board.
- Some elements may be controlled by different groups.
- Covers selection of:
  - Cat I, II or III for Abnormal Performance
  - Category A & B on Reactive Power & Voltage Regulation
  - Settings for both
- PJM already meeting with utilities on these issues.

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NRECA Papers

- Series of Four Tech Surveillance Articles on Cooperative.com:
  - ***The Background For Change***
  - ***Reactive Power and Voltage Regulation***
  - ***Disturbance Performance***
  - ***Power Quality and Other Concerns***
  - **NRECA Articles on Development of IEEE 1547**

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Thank You!

Questions?

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