Voltage quality regulation in Sweden

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Voltage quality in Sweden

- Responsibility of the network operator
- VQ monitoring only for internal use, no publication
- The regulatory process is triggered by a complaint
  - Step 1: try to reach agreement
  - Step 2: the regulator investigates the case
  - Step 3: the regulator can enforce measures on the network operator (measurements,remedying actions)
What is acceptable voltage quality?

• Situation before
  – EN 50160
  – Reasonable number of events (dips, swells)
• A new set of limits
  – 100% of the time values for most of the EN 50160 levels
  – EN 50160 for flicker
  – New requirements for dips and swells
• No complaints = acceptable quality

Voltage-quality variations

• Harmonics
  – EN 50160 levels hold 100% of time
  – MV levels for HV harmonics 17 – 25
• Unbalance
  – At most 2%, 100% of time
• Flicker
  – 95% of Plt during one week less than 1.0
• Slow voltage variations
  – All 10-minute values between 90 and 110%
Responsibility sharing curve

Installations should tolerate these dips

Limitations on the number of dips

Duration of the dip

Voltage dips: Swedish regulation

Installations should tolerate these dips

A reasonable number of dips is acceptable

Dips are unacceptable

Duration of the dip
How to choose the curves?

- Dips, up to 45 kV
  - CIGRE/CIRED/UIE working group C4.110

- Dips, above 45 kV
  - Discussion between the stakeholders

- Swells, up to 1 kV
  - Protection requirements microgeneration
  - Highest overvoltages during earthfaults
  - Experiments on equipment damage

Dips nominal voltage above 45 kV
Voltage swells, up to 1 kV

Conclusions

• New specification on what is considered acceptable voltage quality

• Variations: 100% of time

• Dips and swells: responsibility sharing

• Experience to be gained
  – on what are reasonable numbers of dips and swells
  – on whether adjustments need to be made on the responsibility sharing curves. Ideally only one curve