

U.S. DOE-NERC Workshop on Fault-Induced Delayed Voltage Recovery

Workshop Overview and
Recap of 2008 Workshop

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The First Workshop Was Held on April 22, 2008 in Dallas, TX

Recent Utility Experiences with and Responses to Fault-Induced, Delayed Voltage Recovery

- Bob Yinger, Southern California Edison
- Lee Taylor, Southern Company
- Baj Agrawal, Arizona Public Service

The Current State of Electric System Studies on the Technical Basis of Fault-Induced Delayed Voltage Recovery

- Lee Taylor, Southern Company
- Pouyan Pourbeik, Electric Power Research Institute
- Dmitry Kosterev, Bonneville Power Administration and Chair Western Electricity Coordinating Council Load Modeling Task Force

Improving Our Understanding of the Dynamic Performance of Residential Air Conditioning Units

- Richard Bravo, Southern California Edison
- Jay Jayanth, Emerson Climate Technologies
- Robert Helt, Trane



Recent Utility Experiences with and Responses to Fault-Induced, Delayed Voltage Recovery

- FIDVR - a new acronym!
- Situation dependent: high system loads, large contribution by induction motors (AC) AND a fault
- System solutions expensive, inevitable, and can only limit spread
- Under-voltage load shedding represents a safety net for the system (some customers will still lose power)
- Uncontrolled cascading voltage collapse must be avoided
- Customer ultimately pays for (un)reliability



The Current State of Electric System Studies on the Technical Basis of Fault-Induced Delayed Voltage Recovery

- Dynamic phenomena, not appropriate to study with steady-state models
- Current state-of-knowledge adequate to justify utility actions/investments
- There remain important gaps in our understanding that are being addressed by significant on-going research activities – focus on data (motor properties; load composition) more so than models, themselves
- Can't stop stalling completely with supply-side actions; can only accelerate recovery – longer recovery = greater risk



Improving Our Understanding of the Dynamic Performance of Residential Air Conditioning Units

- Measurements confirm stalling voltage increases as function of temperature; even higher stalling voltage for overcharged units -> 2x increase in real power; 7x increase in reactive power
- Retrofit devices expensive: capital cost \$80-100 + \$120 installation cost – currently available models may not be fully effective in addressing issue
- Currently, protection based on thermal criteria (3-15 sec); overcharge or loss of coolant add time to trip – but cannot trip faster on thermal criteria
- Electronics-based solutions, which can trip faster, are currently used in larger machines
- Higher current during restart is a secondary consideration – can be addressed with existing solutions
- Short-cycle controls can trip rapidly, but may be “insulated” from line voltages



Summary of Closing Workshop Discussions

- Avoid unintended consequences
 - We also need to manage over-voltage after AC units trip
 - And there could be transient stability concerns following large load drops
 - Still, there is adequate time to study and address these issues
- National solutions are preferable
 - Standards should focus on specifying “what”; let manufacturers determine “how”
 - Goal is to minimize total societal cost of all solutions (supply-side + demand-side), taken together – again, customer pays, ultimately, one way or the other
 - Energy-efficiency standards, per se, cannot be blamed for causing the problem; some designs, in fact, lower risks to the system
- Continue the dialog
 - Sharing models, information, points of view is essential for moving forward



Today's Workshop

NERC Transmission Issues Subcommittee White Paper – Introduction to FIDVR

Eric Mortensen, Chair NERC Transmission Issues Subcommittee
Bob Cummings, NERC

Recent Efforts to Improve Our Understanding of FIDVR

Bob Cummings, NERC – moderator
Dmitry Kosterev, Bonneville Power Administration
John Undrill, John Undrill, LLC
Richard Bravo, Southern California Edison

Roundtable Discussion of Outstanding Issues and Options for the Path Forward

Joe Eto, LBNL – moderator
Bob Cummings, NERC
Bob Snow, Federal Energy Regulatory Commission
David Till, Tennessee Valley Authority
Tim Hawkins, Rheem Mfg. Co.

Summary, Discussion, Next Steps, and Wrap Up

Joe Eto, LBNL
Bob Cummings, NERC

