

IEEE 1366 & Regulatory Implications

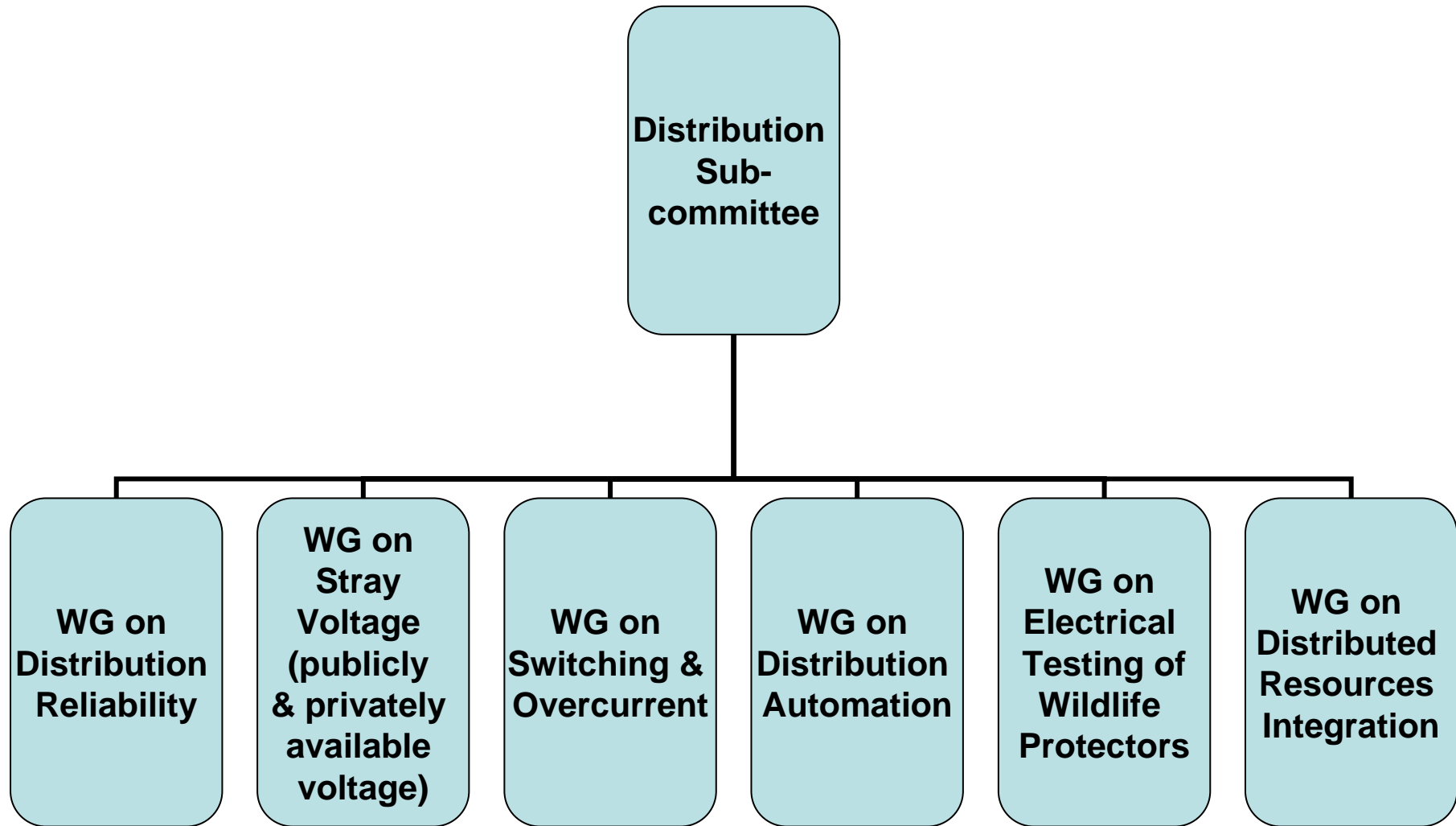
SEE Conference Orlando, FL

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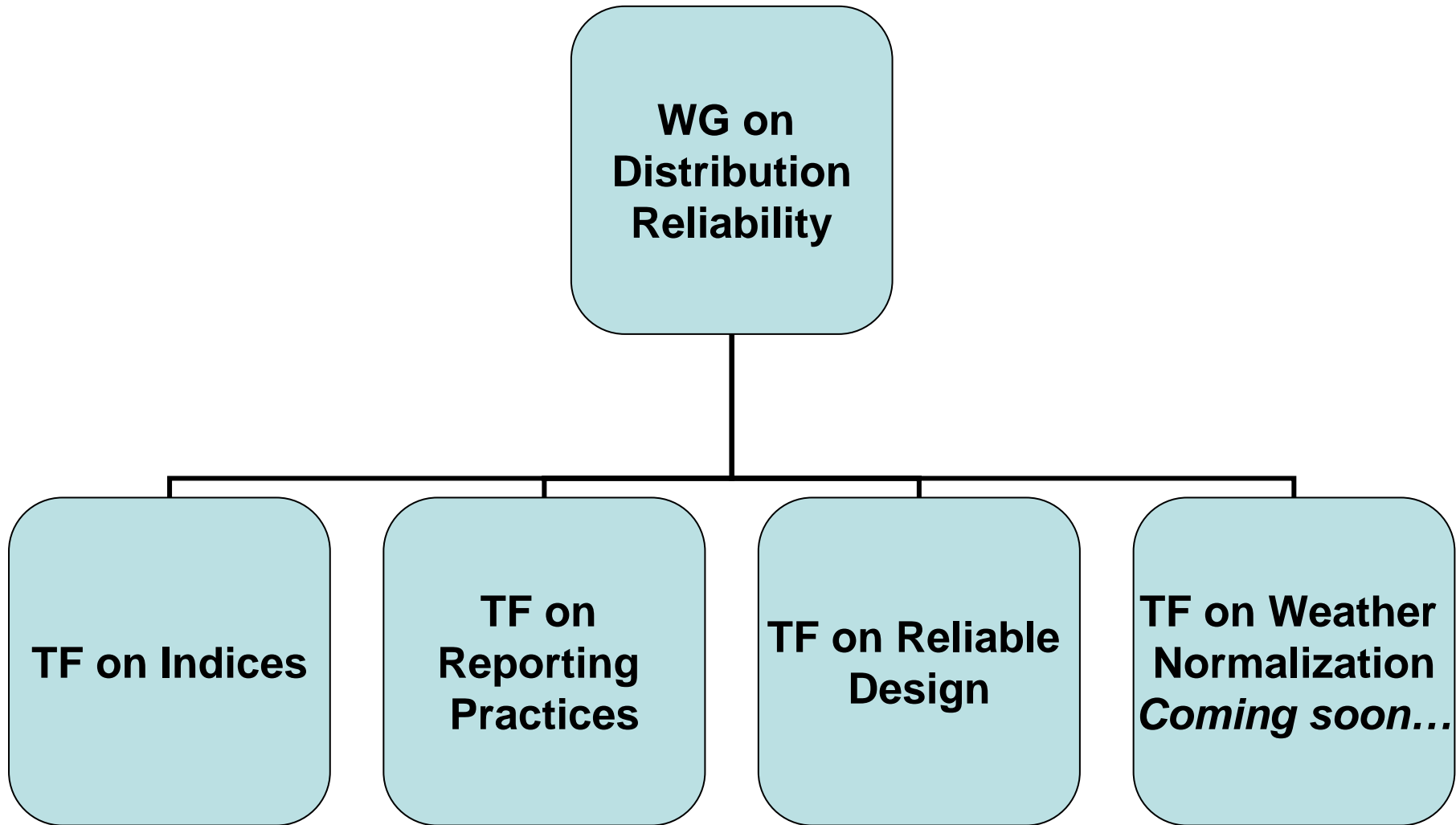
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IEEE Distribution Subcommittee



IEEE WG on Distribution Reliability



Industry Guidelines Developed

- ◆ Project undertaken by IEEE/PES T&D Committee Distribution Subcommittee Working Group on System Design in 1991
- ◆ IEEE Trial-Use Guide for Electric Power Distribution Reliability Indices published in 1999 (IEEE Std 1366-1998)
- ◆ Reaffirmed in 2001
 - ◆ IEEE Guide for Electric Power Distribution Reliability Indices published in 2001 (IEEE Std 1366, 2001 Edition)
- ◆ IEEE Guide for Electric Power Distribution Reliability Indices published in 2004 (IEEE Std 1366-2003)

Purpose of IEEE Std 1366

“The purpose of this guide is twofold. First, it is to

present a set of terms and definitions which can be used to foster uniformity in the development of distribution service reliability indices, to identify factors which affect the indices, and to aid in consistent reporting practices among utilities

Secondly, it is to provide guidance for new personnel in the reliability area and to provide tools for internal as well as external comparisons.”

Definitions

- ◆ **Connected load**
- ◆ **Customer**
- ◆ **Customer Count**
- ◆ **Distribution system**
- ◆ **Interruption**
- ◆ **Interruption duration**
- ◆ **Interruption, unplanned**
- ◆ **Interruption, momentary**
- ◆ **Interruption, momentary event**
- ◆ **Interruption, planned**
- ◆ **Interruption, sustained**
- ◆ **Interruptions caused by events outside of distribution**
- ◆ **Interrupting device**
- ◆ **Lockout**
- ◆ **Loss of service**
- ◆ **Major Event Day**
- ◆ **Outage**
- ◆ **Outage, Planned**
- ◆ **Outage, Forced**
- ◆ **Step restoration**
- ◆ **Total # of customers served**
- ◆ **Reporting period**

Momentary vs. Sustained Interruptions

- ◆ Using 1 minute or 5 minutes should have no appreciable impact on indices so long as the duration is aligned with your operating practices.
- ◆ May only see 1/2 % change in SAIDI.

Key to the Indices

- ◆ S = System
- ◆ A = Average
- ◆ C = Customer
- ◆ Calculated
 - ◆ annually
 - ◆ by system
 - ◆ by operating district
 - ◆ by feeder
- ◆ Categories
 - ◆ Sustained
 - ◆ Momentary
 - ◆ Customer
 - ◆ Load
 - ◆ Average
 - ◆ Specific

The Indices (or alphabet soup)

◆ SAIFI

- ◆ System Average Interruption Frequency Index

◆ SAIDI

- ◆ System Average Interruption Duration Index

◆ CAIDI

- ◆ Customer Average Interruption Duration Index

Many of these indices are not widely used.

Other indices

◆ CTAIDI

- ◆ Customer Total Average Interruption Duration Index

◆ CAIFI

- ◆ Customer Average Interruption Frequency Index

◆ ASAI

- ◆ Average Service Availability Index

◆ ASIFI

- ◆ Average System Interruption Frequency Index

◆ ASIDI

- ◆ Average System Interruption Duration Index

◆ MAIFI

- ◆ Momentary Average Interruption Frequency Index

◆ MAIFI_E

- ◆ Momentary Average Interruption Event Frequency Index

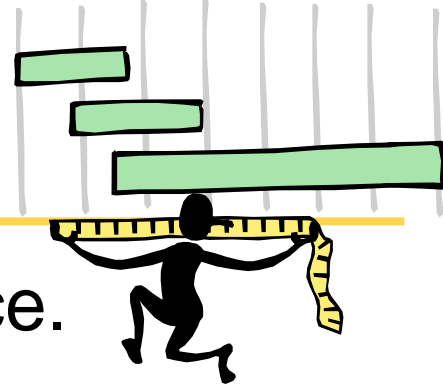
◆ CEMI_n

- ◆ Customers Experiencing Multiple Sustained Interruptions more than n

◆ CEMSMI_n

- ◆ Customers Experiencing Sustained and Momentary Interruptions more than n

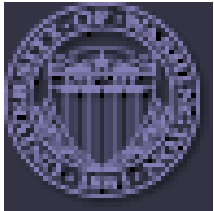
Why Use 1366-2003



- ◆ Sound Basis for Measuring Performance.
- ◆ A clearer view of performance, both on a
 - ◆ Daily basis and
 - ◆ During Major Events
- ◆ Can form a solid basis for review of operational effectiveness, decision making and policy making.
- ◆ More consistent benchmarking.

Methodology Development

- ◆ IEEE WG on System Design, that has over 130 members, developed the “2.5 Beta methodology” in IEEE Std 1366 - 2003.
 - ◆ Members include utility employees, regulatory staff, employees from manufacturers, consultants and academics.
 - ◆ Seven members stepped up to perform the analysis.



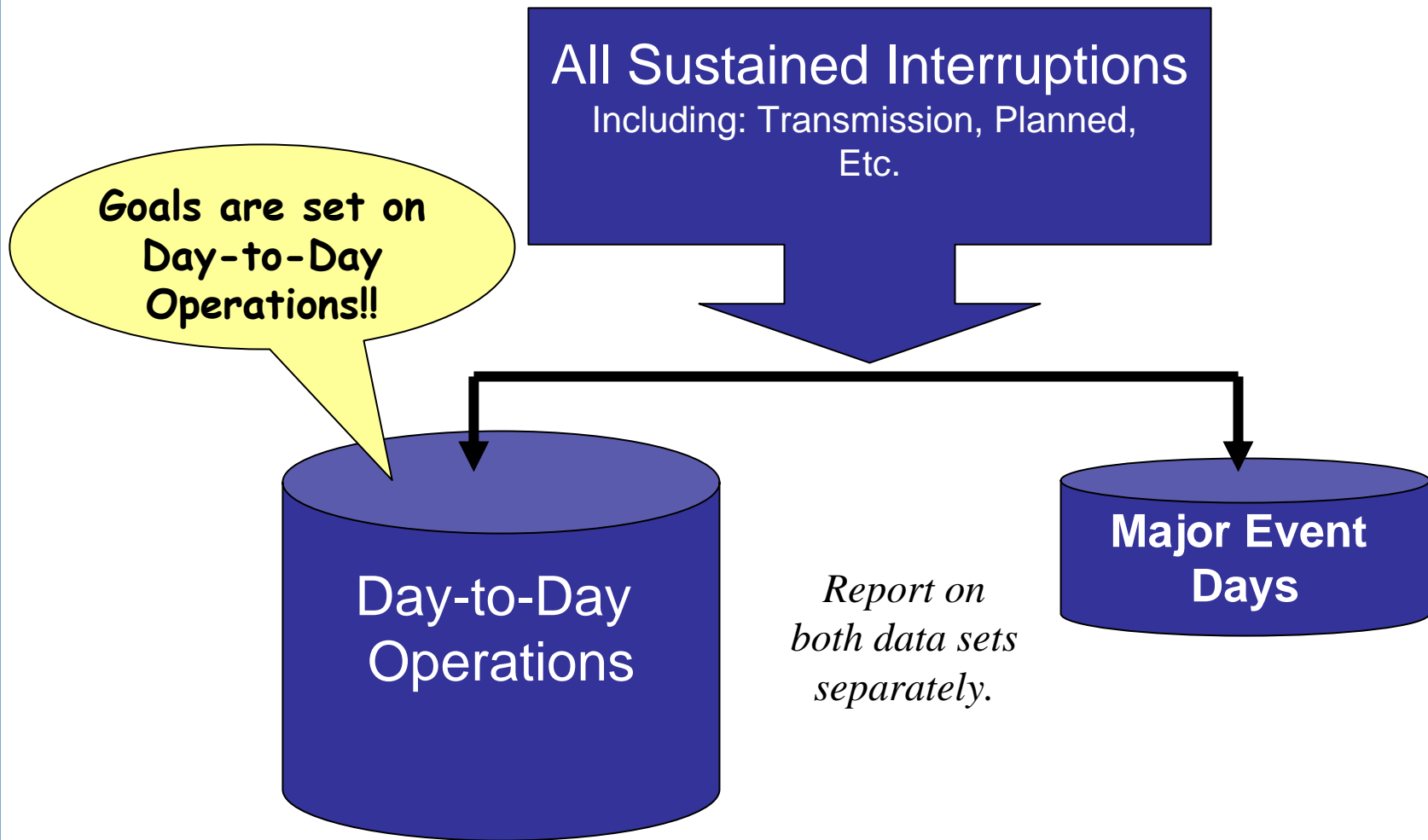
Foundations of the Process

- ◆ Definition must be understandable by all and easy to apply.
- ◆ Definition must be specific and calculated using the same process for all utilities.
- ◆ Must be fair to all utilities.
 - ◆ Large and small, urban and rural....
- ◆ SAIDI was chosen as the indicator...
 - ◆ because it is size independent and
 - ◆ it is the best indicator of system stresses beyond those that utility's staff, build and design to minimize.

Two Categories for Measurement

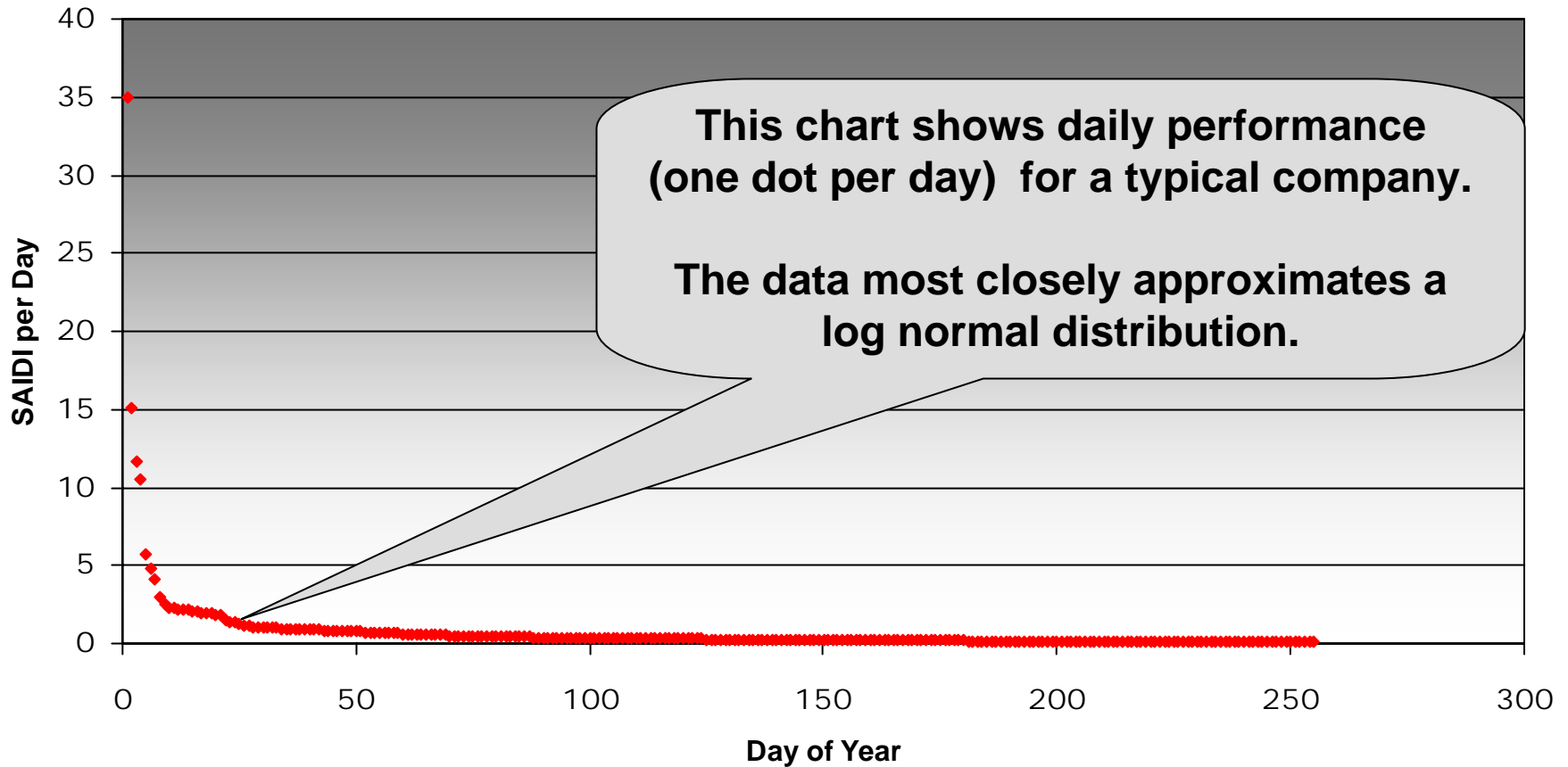
- ◆ The 2.5 Beta Methodology allows segmentation of reliability data into two distinct sets for review.
 - ◆ One set represents those events of such a reliability magnitude that a *crisis mode* of operation is required to adequately respond. (*major events*).
 - ◆ The other set represents the reliability impact of those events that a company has built the system to withstand and staffed to respond to in a manner that does not require a crisis mode of operation. (*day-to-day operation*).

Major Events versus Day to Day Operations



Reliability Performance

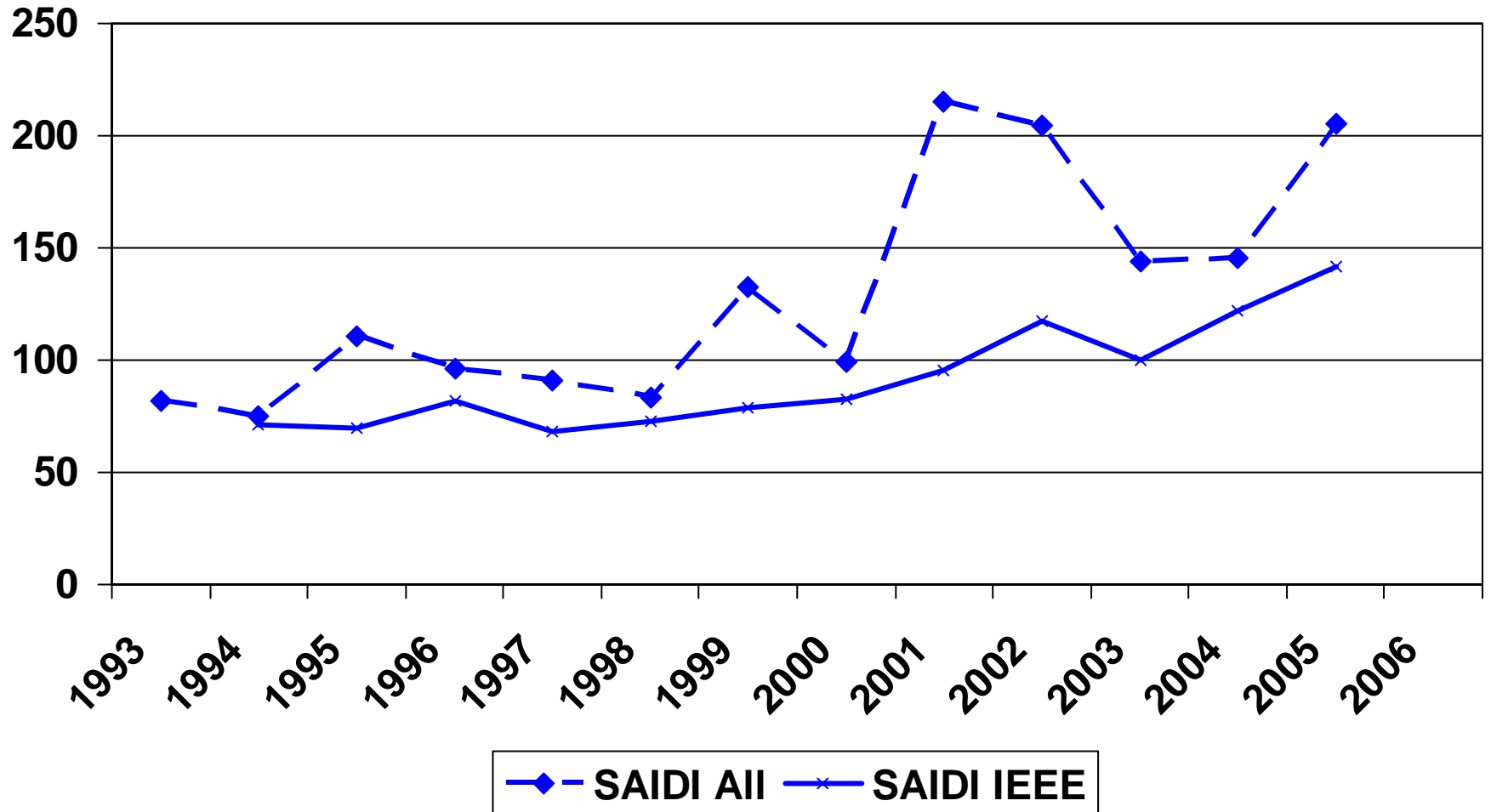
SAIDI per Day



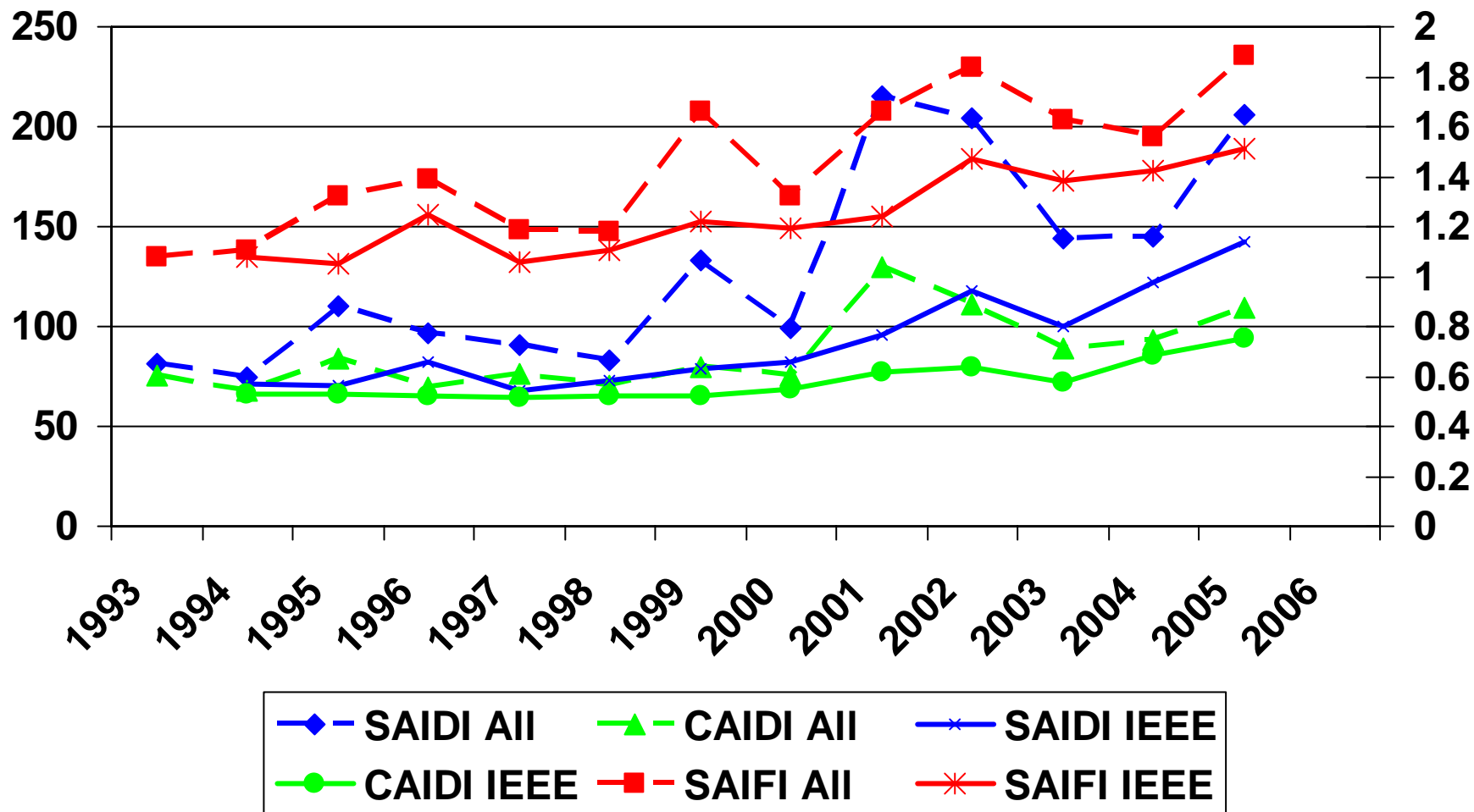
Major Event Days – A few facts

- ◆ A day in which the daily system SAIDI exceeds a threshold value, T_{MED} that is determined by using the 2.5 beta method.
 - ◆ *For example, if $T_{MED} = 3$ minutes, than any day where more than 3 minutes of SAIDI is accrued is declared a major event day.*
- ◆ Statistically, days having a daily system SAIDI greater than T_{MED} are days on which the energy delivery system experienced stresses beyond that normally expected (such as severe weather).
- ◆ Activities that occur on major event days should be separately analyzed and reported. **Nothing is “Excluded”!!**

Example of the Results



Example of the Results



Ramifications on Commission Mandated Targets

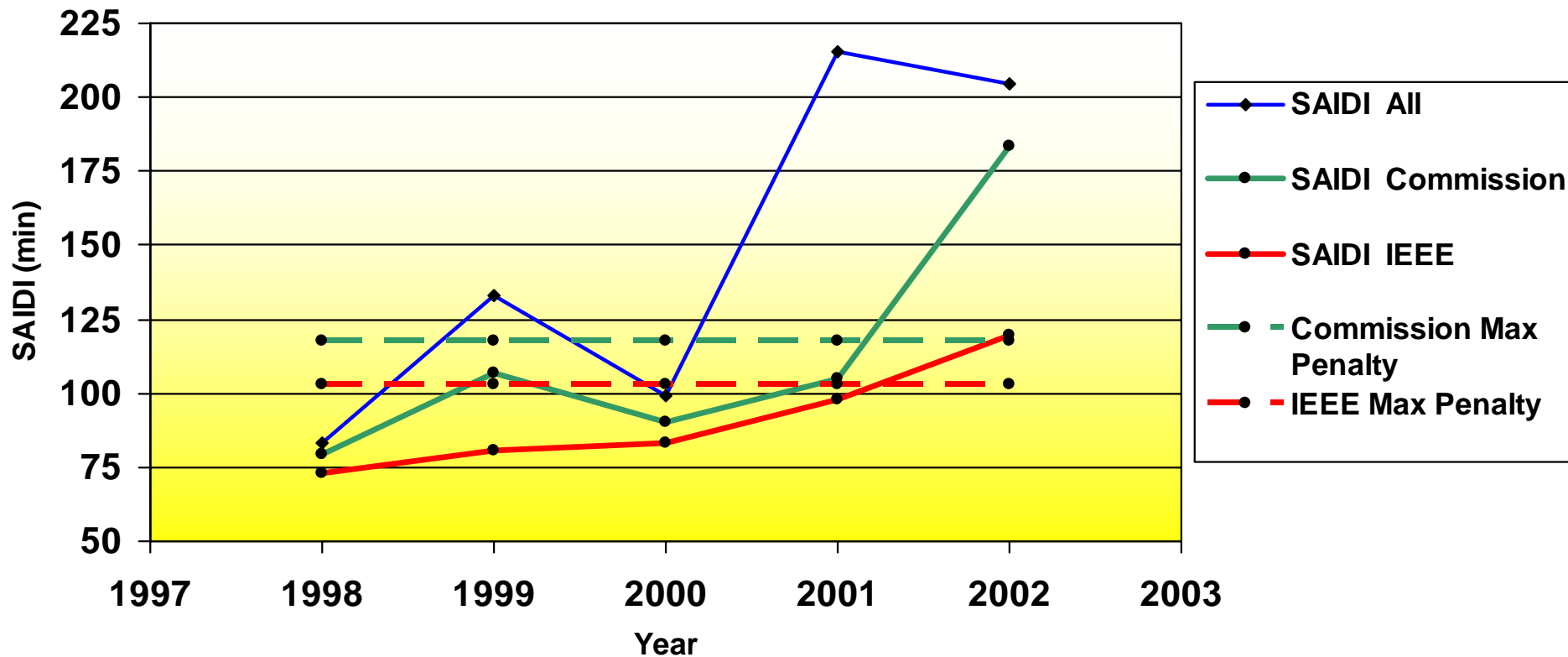
- ◆ Moving to IEEE 1366 will require negotiation with Commissions.
- ◆ If there are existing reliability targets, they will require adjustment.
- ◆ New goals based on this methodology will need to be developed and implemented.

SAIDI Performance

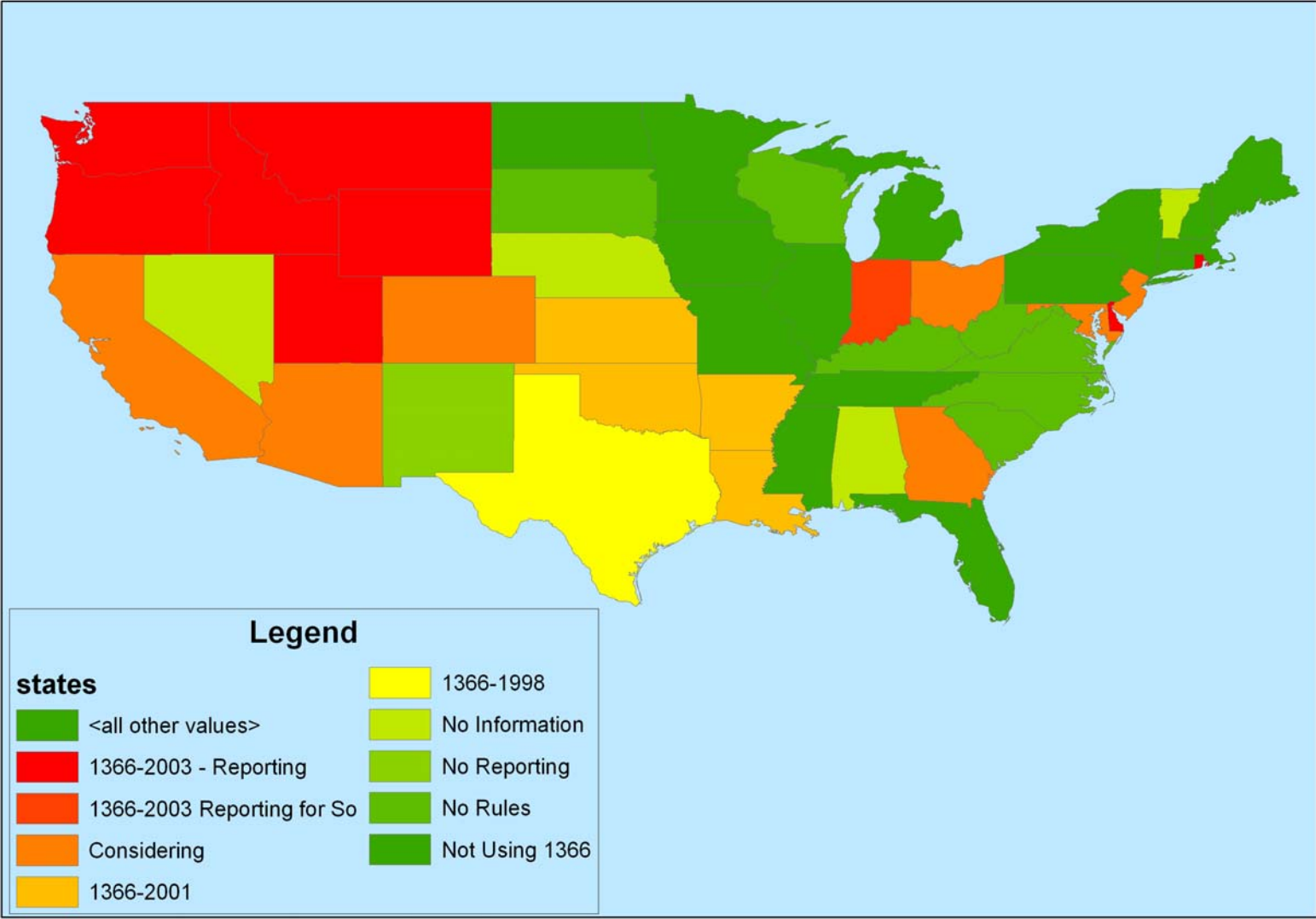
One Company's Performance

Major Event Criteria:

Commision- 15% System, IEEE - 2.5 Beta Method



State Regulator 2006



Source: IEEE WG membership survey

State	IEEE Status	Comment
Alabama	No Information	0
Alaska	No Information	0
Arizona	Considering	0
Arkansas	1366-2001	Utility has to provide its definition of a "major event" when reporting reliability indices in a biannual quality of service report. One company does not use the 2.5 beta methodology, mostly for continuity with past reporting.
California	Considering	Adopted for Pacificorp. Considering for others, but docket is not yet open
Colorado	1366-2003 - Reporting	Rules 3250-3253.
Connecticut	Not Using 1366	UI - A major storm is declared when the number of restoration steps exceeds the 98.5 percentile of all days in the most recent four years. All reliability data associated with interruptions beginning on that qualifying day would be excluded, even if the interruptions extend into subsequent days. CLP - The exclusion is based on the # of trouble spots per division within the company.
Delaware	1366-2003 - Reporting	State has officially adopted the use of IEEE 1366-2003 for indices reporting purpose effective January 1, 2005.
Florida	Not Using 1366	The Florida Public Service Commission allows outage exemptions based on a 'Named Storm' classification. This mainly includes all Hurricanes but may be expanded based on petition from an affected utility experiencing unusual outages caused by any extreme weather condition.
Georgia	Considering	Reported for the first time in 2005. Did not use 1366, but told regulators they would be using 1366-2003 in 2006.

State	IEEE Status	Comment
Hawaii	Not Using 1366	0
Idaho	1366-2003 - Reporting	At least for Pacificorp.
Illinois	Not Using 1366	They report all outages
Indiana	1366-2003 Reporting for Some	The Indiana Administrative Code 170 IAC 4-1-23 was amended in September of 2004. A working group of utilities could not develop consensus on the definition of a "major event" during the development process. With the amendment, each utility must submit its definition of major event with its annual reliability report. At least one company uses the 2.5 beta method since no annual reporting was required until 09/2004, after IEEE 1366-2003. Cinergy does not
Iowa	Not Using 1366	Major event will be declared whenever extensive physical damage to transmission and distribution facilities has occurred within an electric utility's operating area due to unusually severe and abnormal weather or event and: 1. Wind speed exceeds 90 mph for the affected area, or 2. One-half inch of ice is present and wind speed exceeds 40 mph for the 3. Ten percent of the affected area total customer count is incurring a loss of service for a length of time to exceed five hours, or 4. 20,000 customers in a metropolitan area are incurring a loss of service for a length of time to exceed five hours.
Kansas	1366-2001	0
Kentucky	No Rules	No formal reporting
Louisiana	1366-2001	Has an explicit definition of "major event" in the General Order in Docket U-22389 that is very similar to that used by TX, "A catastrophic event that exceeds the design limits of the electric power system, such as an extreme storm. These events shall include situations where there is a loss of service to 10% or more of the customers in a region, and where full restoration of all affected customers requires more than 24 hours from the beginning of the event."

State	IEEE Status	Comment
Maine	Not Using 1366	0
Maryland	Considering	IEEE is not adopted at this time, there are dialogues between utilities and state regulator on this subject.
Massachusetts	Not Using 1366	15% of the territory over the storm
Michigan	1366-1998	New reporting requirements were established in Case No. U-12270 effective February, 2004. These requirements do not even use traditional IEEE indices. Additionally, the specified definition of "Catastrophic conditions" means either of the following: (i) Severe weather conditions that result in service interruptions for 10% or more of a utility's customers. (ii) Events of sufficient magnitude that result in issuance of an official state of emergency declaration by the local, state, or federal government."
Minnesota	Not Using 1366	This state accepts Xcel's Definition and is based on number of daily outages
Mississippi	No Information	0
State	IEEE Status	Comment
Missouri	Not Using 1366	No Mandated Storm Definition
Montana	1366-2003 - Reporting	For utilities that are using 1366-2003, the commission wants them to report indices on that basis. 38-2-187-adp.pdf. Administrative Rules of Montana (ARM) 38.5.8601 to 38.5.8619.
Nebraska	No Information	0
Nevada	No Information	0

State	IEEE Status	Comment
New Hampshire	Not Using 1366	0
New Jersey	Considering	IEEE is not adopted at this time, there are however working groups among utilities and state regulator working on this subject currently.
New Mexico	No Reporting	0
New York	Not Using 1366	0
North Carolina	No Rules	0
North Dakota	Not Using 1366	This state accepts Xcel's Definition and is based on number of daily outages
Ohio	Considering 1366-2003	Each utility has its definition of "major storm or comparable term" approved by the commission for submitting reliability indices in accordance with Electrical Service and Safety Standards (ESSS), rules 10 and 11. One company does not use 2.5 beta because historical targets were set using another definition and this company has not had an opportunity to update its Ohio targets because of some other proceedings. The PUCO staff has circulated several questionnaires and my opinion is that they appear to be interested in mandating the 2.5 beta methodology in the next revision to the ESSS Rules.
Oklahoma	1366-2001	OK has an explicit definition of "major event" in Chapter 35. Electric Utility Rules. This definition is similar to AR and TX and is, "a catastrophic event that exceeds the design limits of the electric power system, such as an extreme storm, tornado or earthquake. These events shall include situations where there is a loss of service to 10% or more of the customers in a region, and where full restoration of all affected customers requires more than 24 hours from the beginning of the event." This commission has asked a few questions about the 2.5 beta methodology since (and even while) updating its rules in July of 2004.
Oregon	1366-2003 - Reporting	For Pacificorp

State	IEEE Status	Comment
Pennsylvania	Not Using 1366	Outages lasting 24 hours or more that were caused by a single weather event. The event was severe enough to make the local news broadcasts.2) Major event storms are those that affect 10% or more of PPL's total customer base. The effects of these events, upon petition to and approval of the PUC, are excluded from PUC and internal metrics.
Rhode Island	1366-2003 - Reporting	Currently incurs penalties on 10% rule with parallel reporting on IEEE 1366-2003 basis. Next year company can request moving to IEEE 1366-2003 for penalty purposes.
South Carolina	No Rules	0
South Dakota	No Rules	0
Tennessee	No Rules	0
Texas	1366-1998	Has an explicit definition of "major event" in substantive rule 25.52. It seems to be based on an old 1366 definition and is, "Interruptions that result from a catastrophic event that exceeds the design limits of the electric power system, such as an earthquake or an extreme storm. These events shall include situations where there is a loss of power to 10% or more of the customers in a region over a 24-hour period and with all customers not restored within 24 hours."
Utah	1366-2003 - Reporting	For reporting purposes for all IOUs.
Vermont	No Information	0
Virginia	No Rules	Has no rulemaking based requirement, but does issue an annual reliability questionnaire to the utilities. The definition of "major storm" is one of the questions. One company has not used the 2.5 beta methodology in Virginia, but has contemplated "making the switch" for a couple of years.
Washington	1366-2003 - Reporting	At least for Pacificorp, Otherwise 5% of total cust wo service. Commission asking for IEEE 1366-2003.

State	IEEE Status	Comment
Washington DC	1366-2003 - Reporting	<p>DC has adopted the use of IEEE 1366-2003 for the purpose of calculating the indices and establishing performance standards. In May of 2002, the DE Commission, in its order no. 12395 (Formal Case No. 1002) directed Pepco to submit to the Productivity Improvement Working Group (PIWG) the Customer Service and Reliability Standards (CSRS) enumerated in its merger application (Then Pepco and Conectiv).</p> <p>Pepco complied this order with several subsequent filings addressing different area of concerns (Call center, worst performing circuits , prompt restoration, to name just a few...). The proposed distribution system outage performance benchmark section was filed in June of 2003, within them, the Major Event Normalization proposed by Pepco was based on the 2.5 Beta Method.</p> <p>DE Commission has reviewed the CSRS proposed by Pepco and found that adopting them is in the public interest. The approval was granted by the DE Commission in April of 2005. The CSRS was adopted by DC Commission on an interim basis subject to further recommendation from the PIWG.</p>
West Virginia	No Rules	No rules
Wisconsin	No Rules	<p>(10) "Major catastrophic events" means train wrecks, plane crashes, or explosions that are beyond the utility's control and result in widespread system damages causing customer interruptions that affect at least ten percent of the customers in the system or in an operating area and/or result in customers being without electric service for durations of at least 24 hours.(11) "Major storm" means a period of severe adverse weather resulting in widespread system amage causing customer interruptions that affect at least ten percent of the customers on the system or in an operating area and/or result in customers being without electric service for durations of at least 24 hours.</p>
Wyoming	1366-2003 - Reporting	At least for Pacifcorp
BC Canada	Considering	This year is the first year that utilities are proposing/negotiating using the Normalized reporting numbers to our commission. It appears that this approach will be accepted by the BCUC. Currently, BC Hydro is using the Beta 2.5 method for data normalization.

Benefits of the Approach

- ◆ Adoption of the 2.5 Beta methodology
 - ◆ will allow for consistent calculation of reliability metrics,
 - ◆ provide companies and commissions with a more accurate indication of a Company's controllable service quality results,
 - ◆ allow a clear review of company response to crisis mode events, and
 - ◆ provide a less distorted indication of the reliability results for companies of all sizes.

Questions...

