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EMERGING LEADERS FORUM

Distribution Resiliency Metrics

and the future of storm resiliency measurement

Gary B Huffman Jr
Burns & McDonnell Engineering
Chairman – IEEE Distribution Resiliency Working Group
Vice Chair – EEI Distribution Reliability / Resiliency Working Group

Shikhar Pandey, Ph.D.
ComEd – An Exelon Company
Senior Engineer
Chairman – IEEE Distribution Resiliency Task Force

IEEE ORG Structure

IEEE PES
Transmission & Distribution Committee

IEEE PES
Distribution Subcommittee

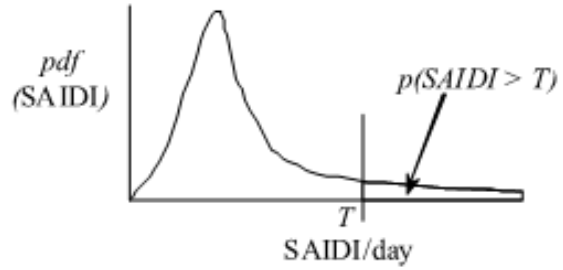
IEEE PES
Distribution Resiliency Working Group

DRWG Task Force

In the beginning…. there was reliability

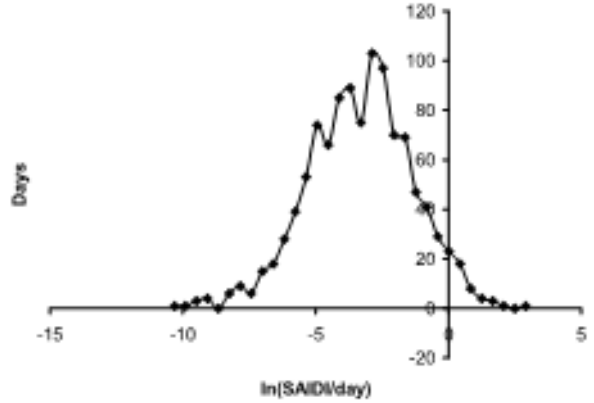
IEEE P1366-2012 - Guide For Electric Power Distribution Reliability Indices

- Originally approved 1998
- Current Guide: 2012
- Revision: Forecast Q4 2022 (Ballot comments underway)



IEEE P1782 - Guide For Electric Power Distribution Reliability Indices Reporting Practices

- Originally approved 1998
- Current Guide: 2014
- Revision: Forecast Q3 2022 (passed Ballot Q4 2021)



IEEE Pxxxx - Reliability Data Analytics & Benchmarking (consideration)

IEEE P2845- Celebratory Balloon Testing Guide (Initial draft working)

Why Have Resiliency Metrics

Customer expectations are rising

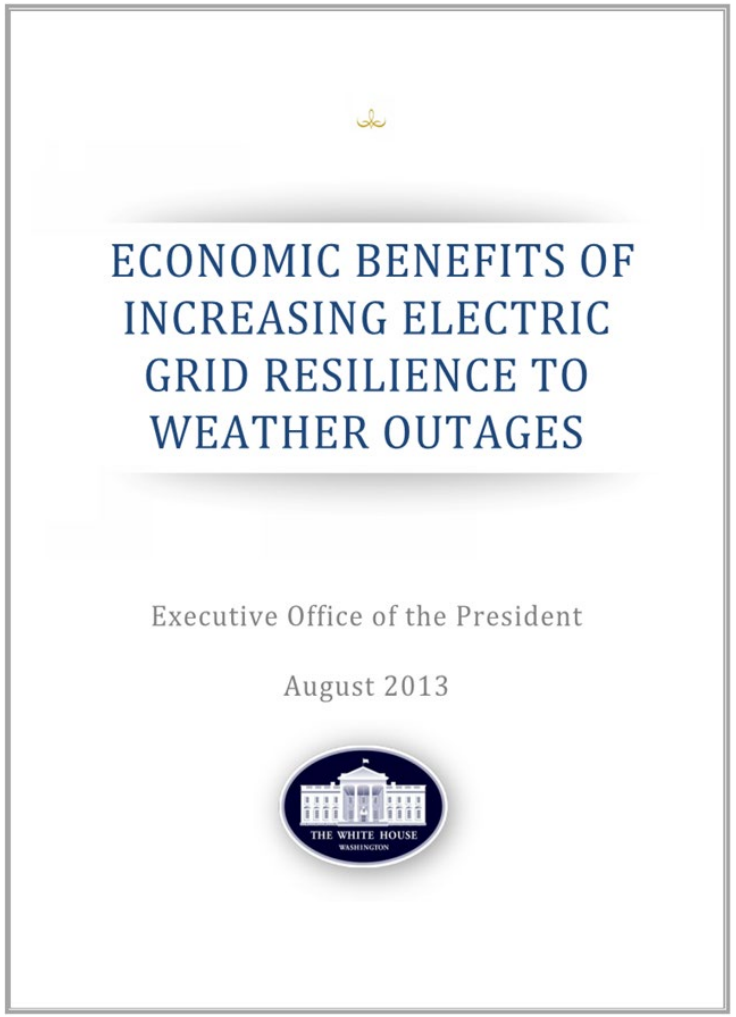
- The “Amazon” experience
- Power sensitive industries
- Work from home / home businesses

“Major Event Days” – Significant Negative Impact

- Customer Safety
- Economic Output

Performance Based Ratemaking

Investment Justification – Gold Plating or Major Event Protection?



Major Event Days…

Major Event
Designates an **event that exceeds reasonable design and or operational limits** of the electric power system. A Major Event includes at least one Major Event Day.

Major Event Day (MED)
A day in which the daily system System Average Interruption Duration Index (SAIDI) exceeds a Major Event Day threshold value. For the purposes of calculating daily system SAIDI, any interruption that spans multiple calendar days is accrued to the day on which the interruption began. Statistically, days having a daily system SAIDI greater than TMED are days on which the energy delivery system experienced stresses beyond that normally expected (such as during severe weather). **Activities that occur on Major Event Days should be separately analyzed and reported.**


August 30, 2021
8:25 PM EDT
Last Updated 7 months ago

United States

U.S. power utilities struggle to restore power after Ida lashes Louisiana

Reuters


Sandy Ineptitude Catches Up With LIPA At Moreland Commission Hearing

CBS NEWS NEW YORK

DECEMBER 11, 2012 / 11:10 PM / CBS NEW YORK

See IEEE P1366 for more detailed information

What is Resiliency?

FERC has proposed that resilience means the “ability to withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event.”

Credit: Utility Dive Feb 2, 2018 by Kate Konschnik and Brian Murray

IEEE Distribution Resiliency Focus

Out of scope: BES, Cyber/Physical Security, Operational Events

Primary Focus: Extreme Weather Events, Natural Phenomenon

IEEE DRWG Scope of Work?

IEEE SA STANDARDS ASSOCIATION

IEEE

P2856

Submitter Email: befaw@idahopower.com
Type of Project: New IEEE Standard
Project Request Type: Initiation / New
PAR Request Date: 16 Apr 2020
PAR Approval Date: 02 Jun 2020
PAR Expiration Date: 31 Dec 2024
PAR Status: Active

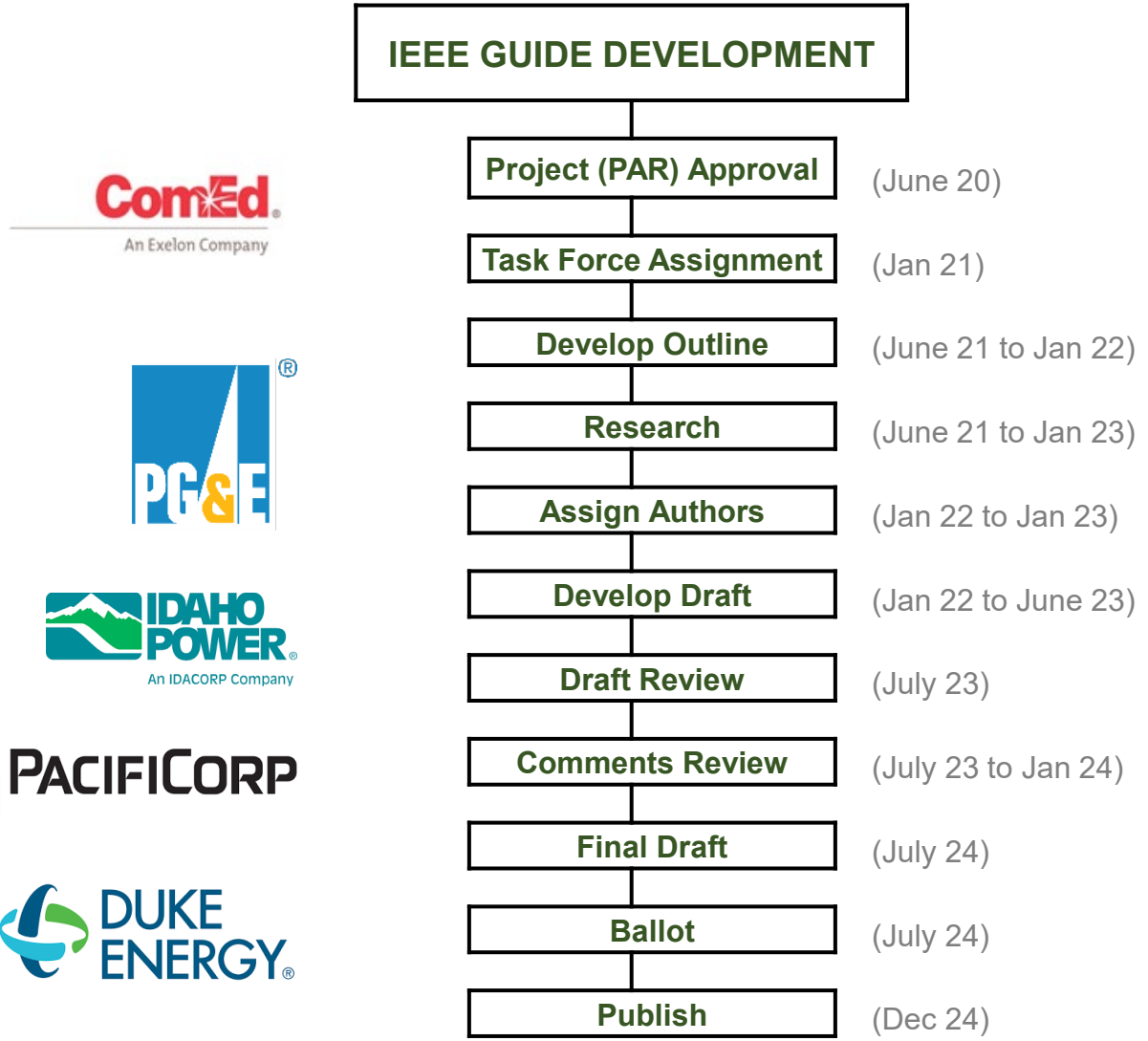
1.1 Project Number: P2856
1.2 Type of Document: Guide
1.3 Life Cycle: Full Use

2.1 Project Title: Guide for the Definition of Resiliency and Measuring the Resiliency of the Electrical Distribution System

IEEE Guide Process

Guide Support

- **Task Force Members**
  - Voting members
  - Reviewers
- **Authors**
  - Co-Authors
- **Case Studies**
  - Geographic diversity
  - Utility size diversity



Resiliency – An Asset Lifecycle View

Design for Resiliency

DESIGN CRITERIA

- Event Assumptions
- Standards Applications
- Risk Analysis
- Diversity
- Redundancy
- Project Selection

Operate for Resiliency

SITUATIONAL AWARENESS

- Data accessibility
- Preparation and staging
- Automation
- Topography
- Mutual Assistance
- Storm Response

Maintain for Resiliency

EFFECTIVE M&I

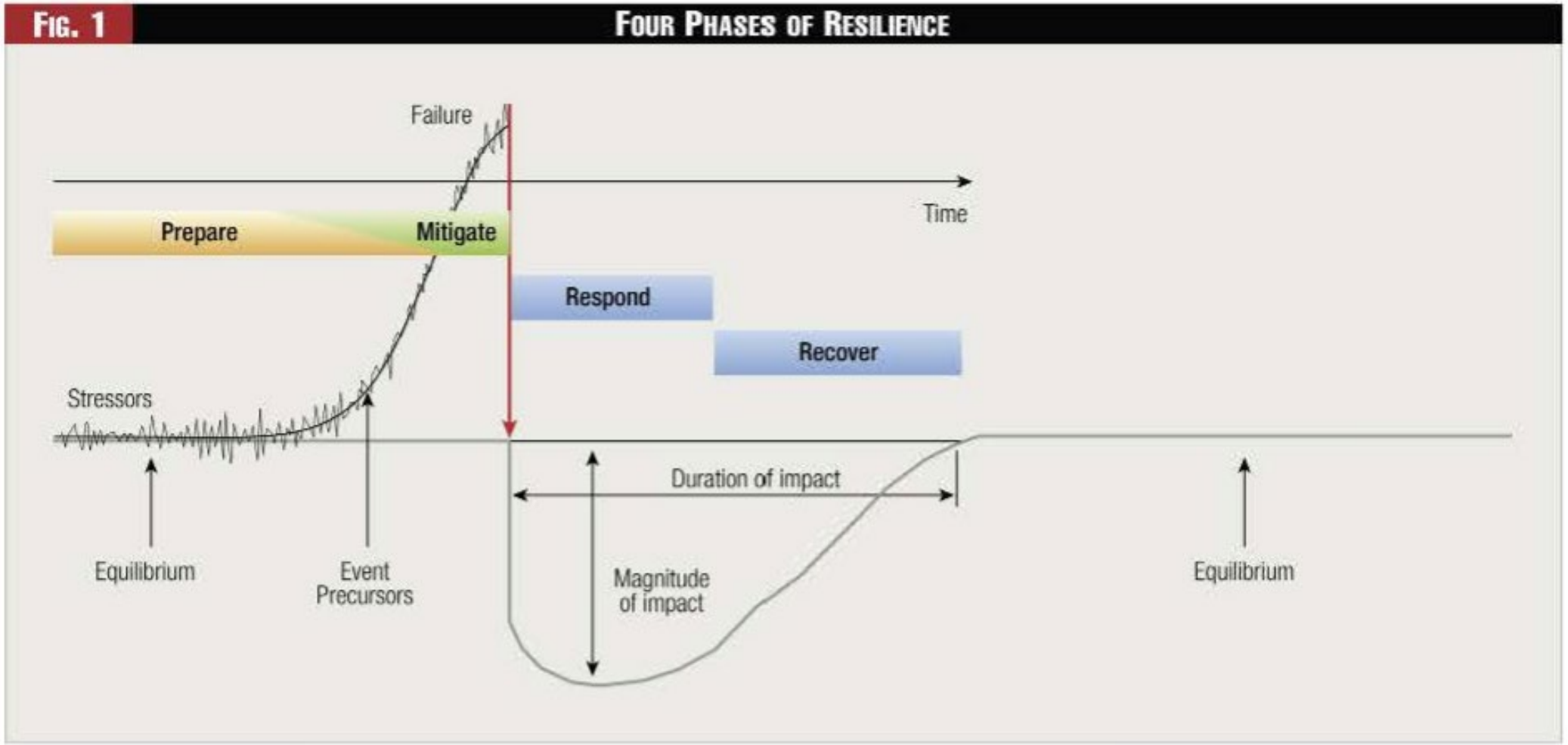
- Programs input to Data Analytics
- Robust inspections post-event
- Equipment life-cycle impacts analysis

Measuring Resiliency

WHAT TO MEASURE

- Define Performance
- Risk Reduction
- Correlate investment
- Diverse scorecard
- Easily Accessible Data
- Support Business Objectives

Resiliency – An Event Perspective



Credit: PUF April 2020 Resiliency From Policy, Regulatory, and Engineering Perspectives

ComEd's Resiliency Metrics

ComEd did not have a good method on measuring the impact of low probability, high consequence events, hazards, or measuring impact to humans

Identified several factors contributing to resilience such as naturally-occurring events like weather, substation events, potential physical and cyber events

Used historical data from previous 5 years to establish thresholds, and calculate median of the data set

ComEd has established two metrics to measure resilience

- Storm resilience that focuses on speed of recovery during the first twelve hours from customers losing power
- Gray Sky Day resilience that focuses on robustness and the ability to withstand most weather events

Shikhar

Recovery Metric

STORM DEFINITION

Weather events resulting in greater than 125 primary sustained interruptions within a 24-hour period or 25,000 sustained customer interruptions. The storm definition includes Reportable and Non-Reportable. An ICC Reportable Storm is defined as a weather event that results in 10,000 or more customers without power for three consecutive hours. A Non-Reportable Storm is defined as all other storms that are not ICC Reportable. Extreme heat and cold events are not considered reportable storms. The basis for reportable storms is Section 83 of the Illinois Administrative Code Part 411.120(a) reporting threshold.

Calculation:

1) For each storm in a calendar year, calculate the ratio of customers without power for more than 12 hours and total customer interruptions (CI) including customers automatically restored (ACI) through smart switch operations (DA devices), community energy storage, and microgrids (does not include substation reclosing events) – measured in %

   Storm Event: $x = \frac{\sum \text{Customers Without Power for More Than 12 Hours}}{\textit{Sustained CI+ACI Due to Distribution Automation}}$

2) Based on number of interruptions (storm outages), categorize each storm event significant, large, medium, or small
3) Determine if X is greater than or equal to the threshold value (Y) for the category.
4) If X < Y, storm met expectations. If X >= Y, storm did not meet expectations

Shikhar

Gray Sky Day Metric

Definition: Achieve up to 50% of total number if Gray Sky Days (GSD) in a Calender year with no more than the target value of customer interruptions.

Measurement: Metric is measured in percentage of GSDs that do not exceed the target value. The target value is set at XXX* customer interruptions.

$$\#\ of\ Gray\ Sky\ days < \frac{XXX\ CI}{Total\ \#\ Grat\ Sky\ Days} = \%\ of\ Success^{**}$$

** XXX can be obtained by utilities based on historical outage*
*** $\%\ of\ Success$ can be set by utilities based on their Median outages during historical Gray Sky Days.*

Participate in the Process

Upcoming Events

IEEE PES General Meeting, Denver, CO July 17-21, 2022

IEEE Joint Technical Committee Meetings (JTCM), Jacksonville, FL January 8-12, 2023

Join the Distribution Resiliency Working Group

Chair: gbhuffman@burnsmcd.com

Vice Chair: mdavoudi@ieee.org

Secretary: bidram@unm.edu

Distribution Resiliency Task Force

Chair: shikhar.pandey@comed.com

Vice Chair: gbhuffman@burnsmcd.com

Secretary: bolanle.sosina@comed.com

Questions?