

Probabilistic Risk Analysis

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Reliability Assessment and Performance Analysis**

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RELIABILITY | ACCOUNTABILITY



To ensure the reliability of the North American bulk power system

- Develop and enforce reliability standards
- Assess current and future reliability
- Analyze system events and recommend improved practices
- Encourage active participation by all stakeholders
- Accountable as ERO to regulators in the United States (FERC) and Canada (NEB and provincial governments)



- Assess, measure, and investigate historic trends and future projections to improve bulk power system reliability
 - Develop solid technical understanding of the reliability risks
 - Insights that guide and inform entities
 - Trends in system performance and events
 - Analyze and benchmark performance
 - Solutions, strategies, and initiatives to enhance bulk reliability
 - Technical reliability center of excellence resource
 - NERC, regulators, and stakeholders

Reliability Assessment Objectives:

- Align data/analytics of system performance
- Refine reliability of assessment
- Link with event analysis and experience
- Develop insights, trends – recommendations/initiatives

Recognize Emerging Landscape:

- Generation resources, supply mix
- Transmission system development, utilization
- Load characteristics

Foundation for a risk-informed ERO Enterprise

2010

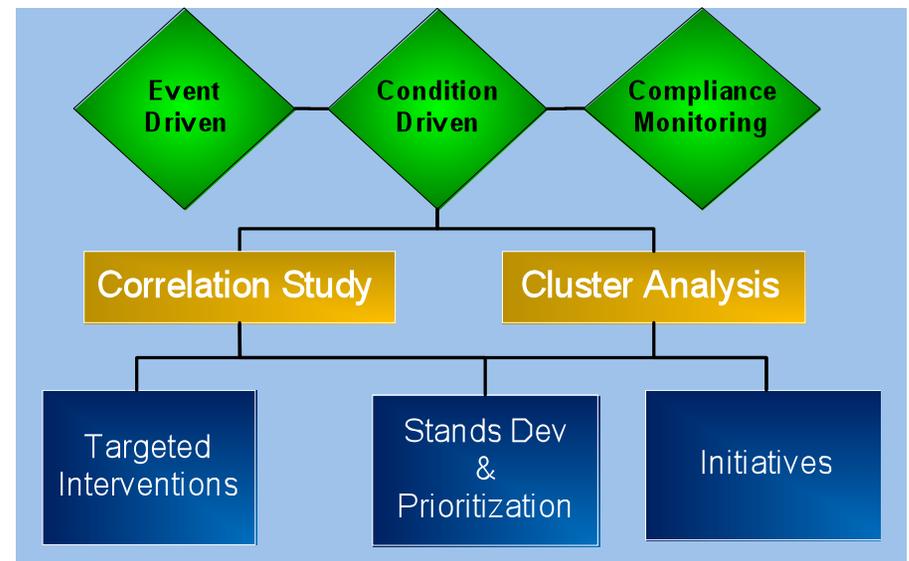
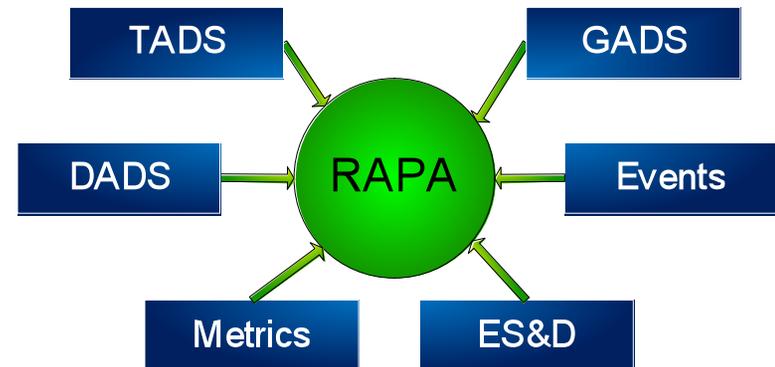
- Develop reliability measures
- Publish performance trending on NERC website
- Refine and implement risk assessment tools

2011

- 18 reliability indicators
- First annual report
- Identify areas of highest risk to reliability
- Recommend standard changes

2012

- Issue annual state of reliability report
- Event-Driven Index (EDI)
- Key Compliance Monitoring Index (KCMI)
- Condition-Driven Index (CDI)



- ***ADS = Availability Data Systems***
 - Generating ADS (1972) – mandatory reporting (2012)
 - Transmission ADS (2008) – mandatory reporting
 - Demand Response ADS (2011) – mandatory reporting
 - Spare Equipment Database (2012) – voluntary reporting
- ***Emerging information/performance***
 - Frequency responses – generators, loads
 - Events analyses – root cause
 - Transmission circuits, transformer, relays
- ***Benchmarking, risk analysis and probabilistic assessment***

Drive towards comprehensive analysis and insights -- promote actions, initiatives, and enhancements to reliability

User

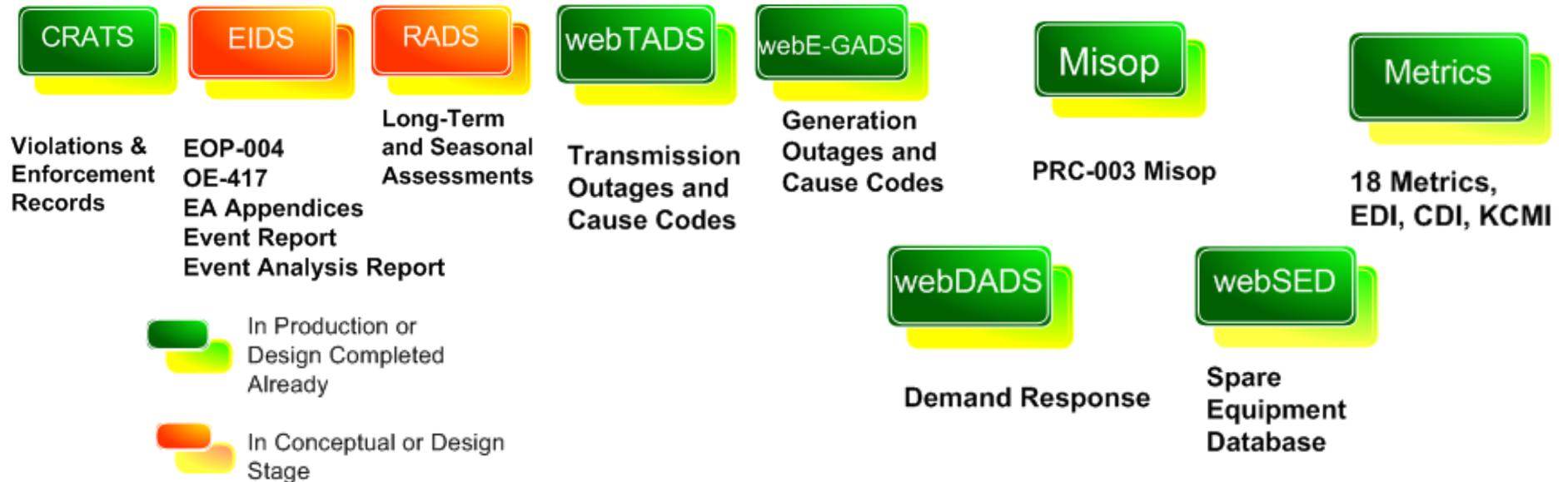
Registered Entities
Regional Entities
NERC



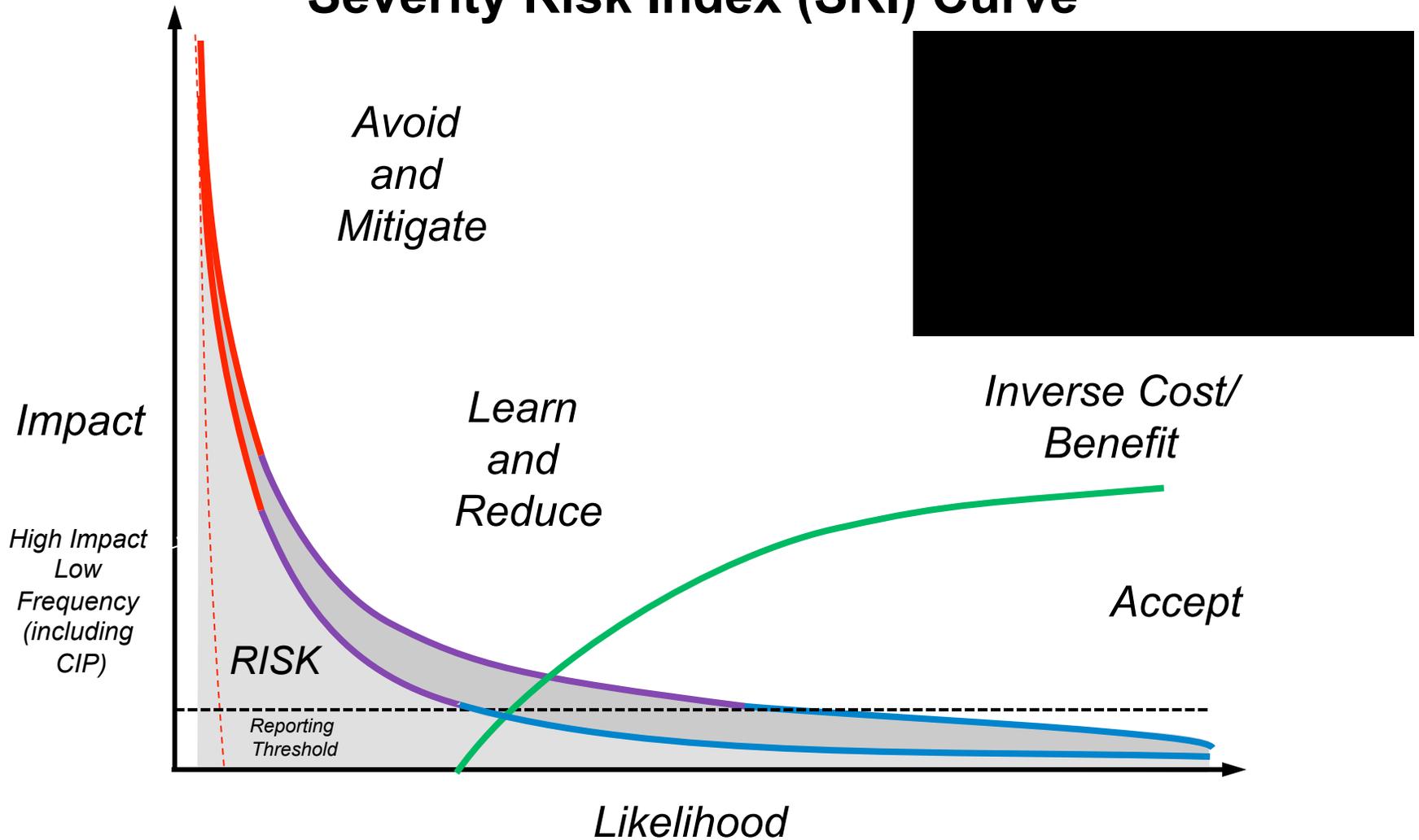
Unified Platform

Registration
Graphical User Interface
Security and Alarm
Information Sharing

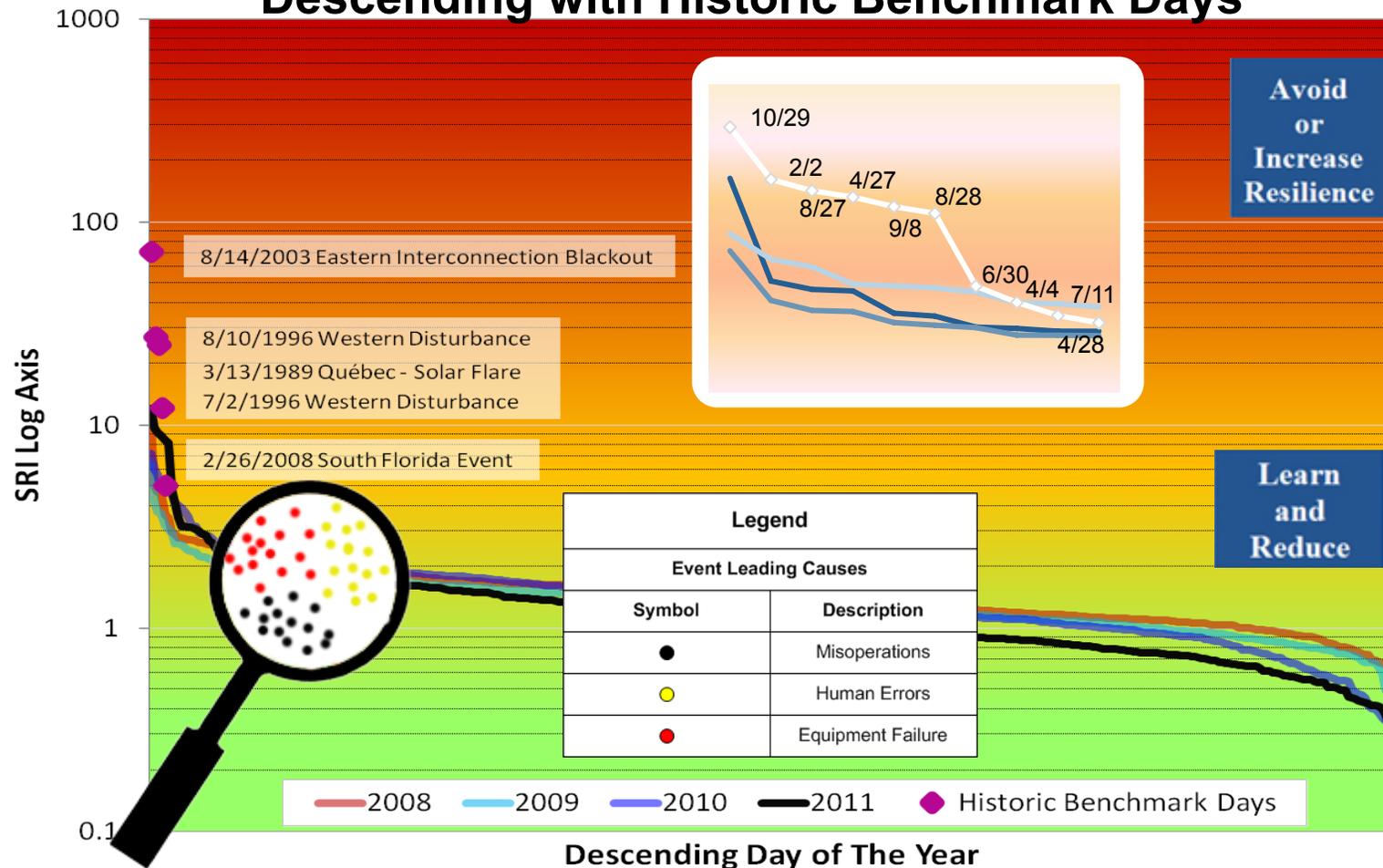
Commonality Relationship



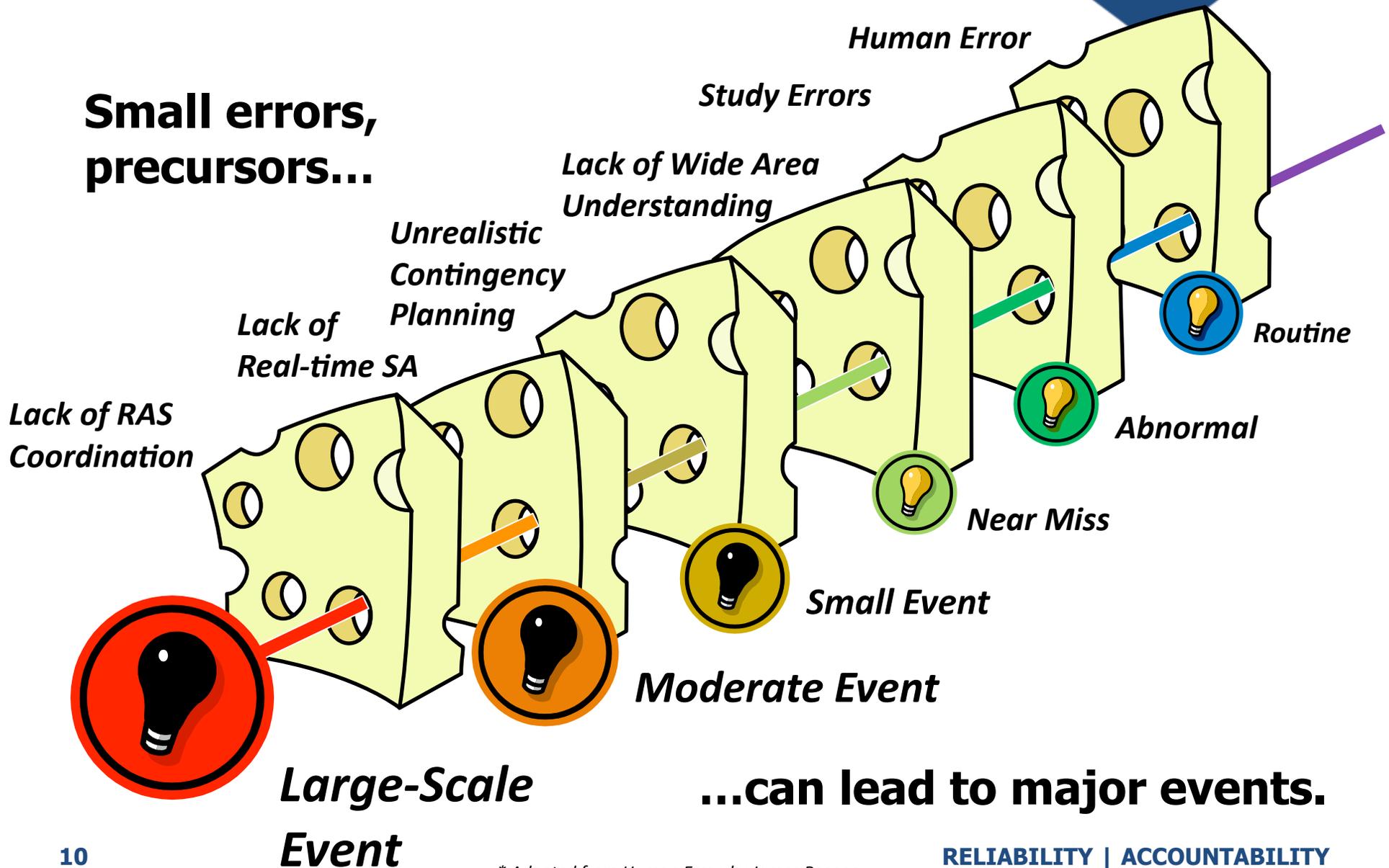
Severity Risk Index (SRI) Curve



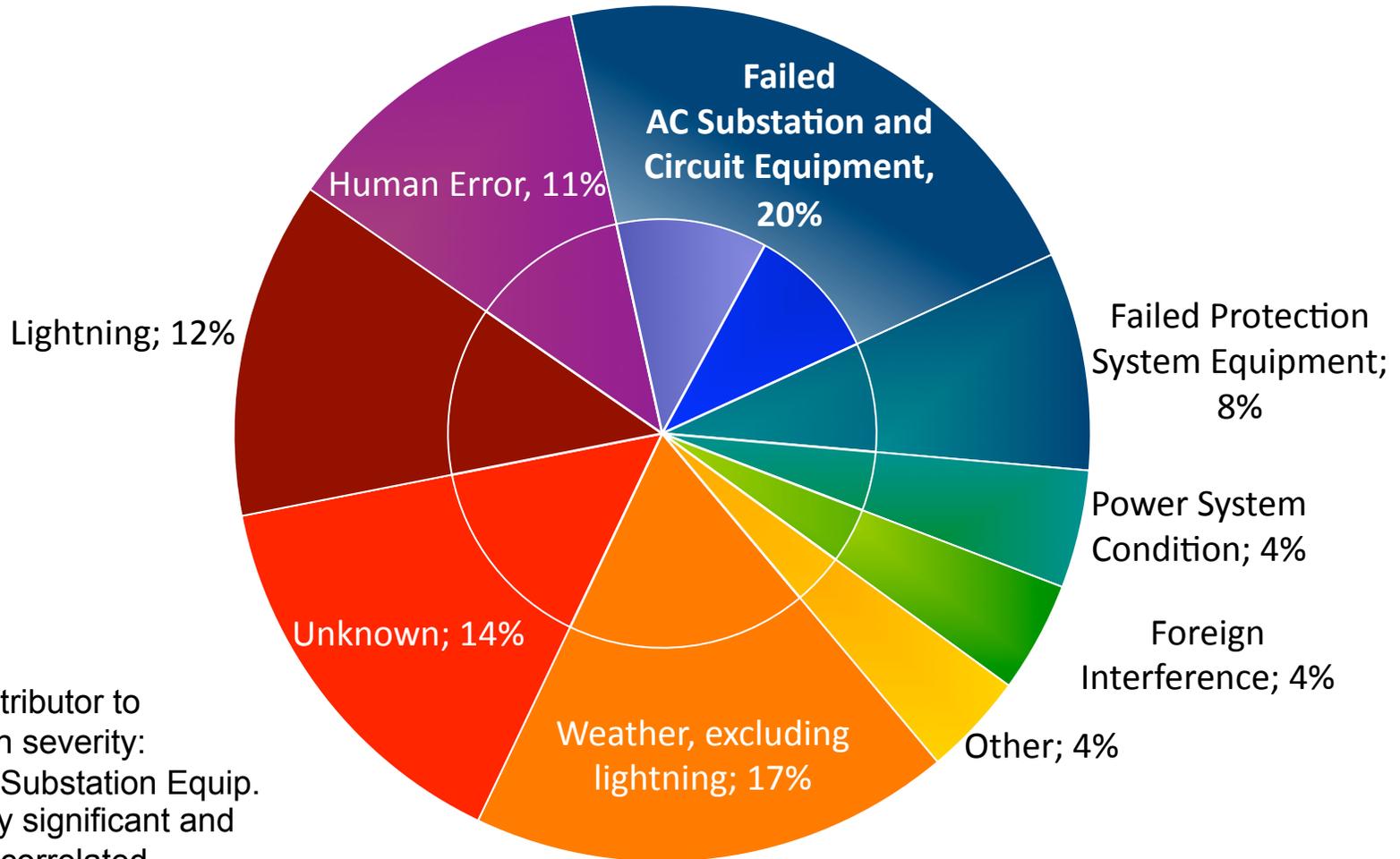
NERC Annual Daily Severity Risk Index (SRI) Sorted Descending with Historic Benchmark Days



Risk Management with Complex, Highly Reliable Systems*



AC Circuit Sustained Automatic Outages by Initiating Cause Code

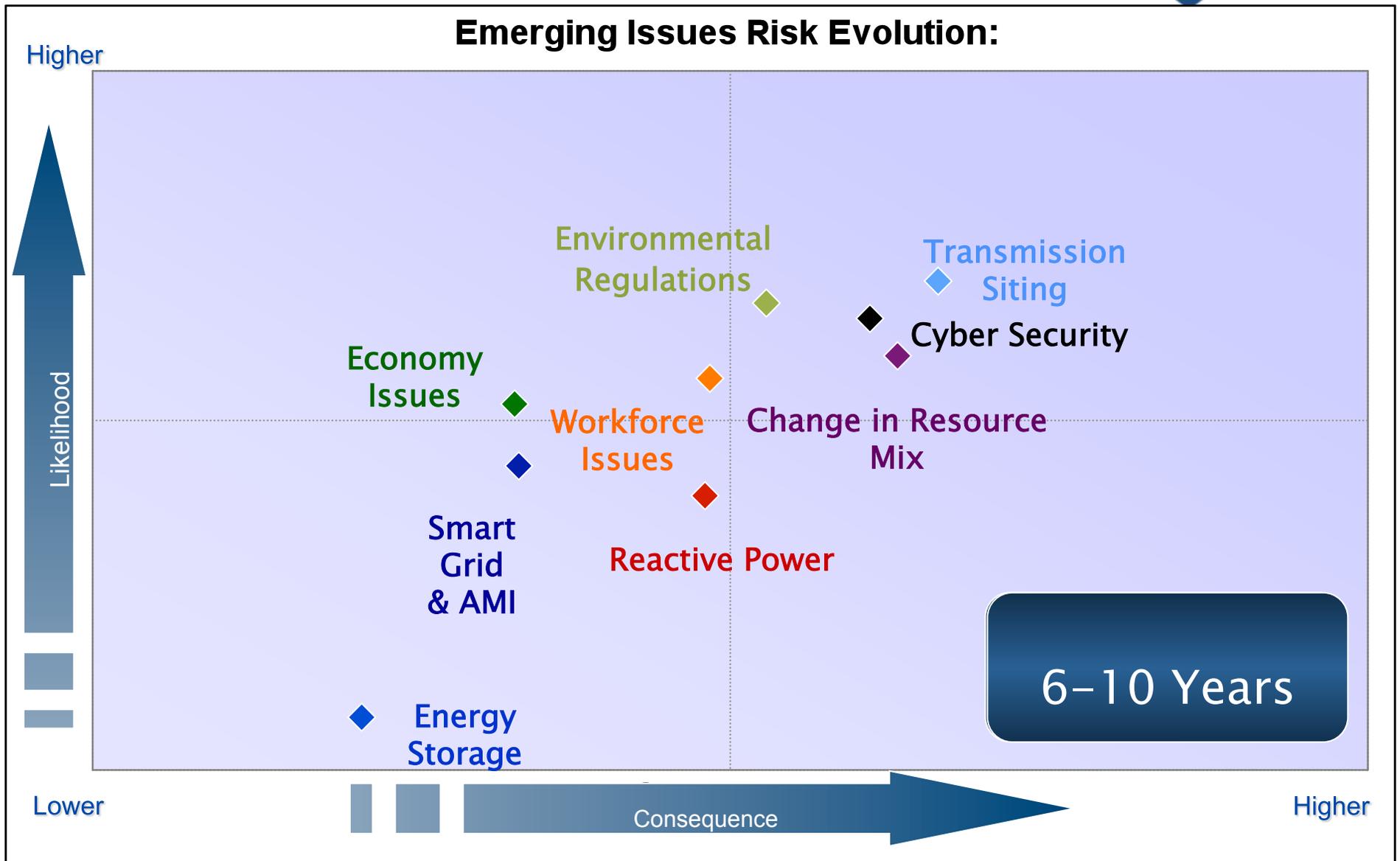


Biggest contributor to transmission severity:
- Failed AC Substation Equip.
- Statistically significant and positively correlated

- Peak demand forecasts
- Resource adequacy
- Transmission adequacy
- Key issues - emerging trends
 - Technical challenges
 - Evolving market practices
 - System elements/dynamics
 - Potential legislation/regulation
- Regional self-assessment
- Ad-hoc special Assessments

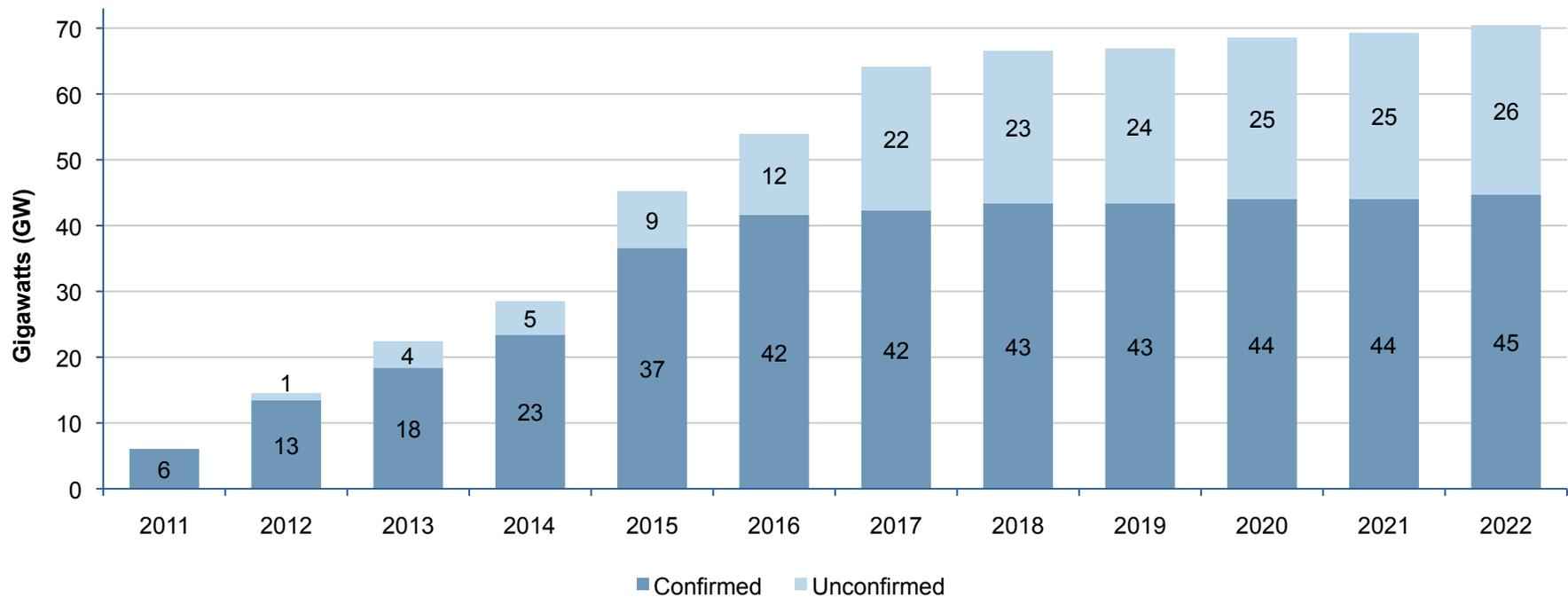


Emerging Issues Risk Evolution:

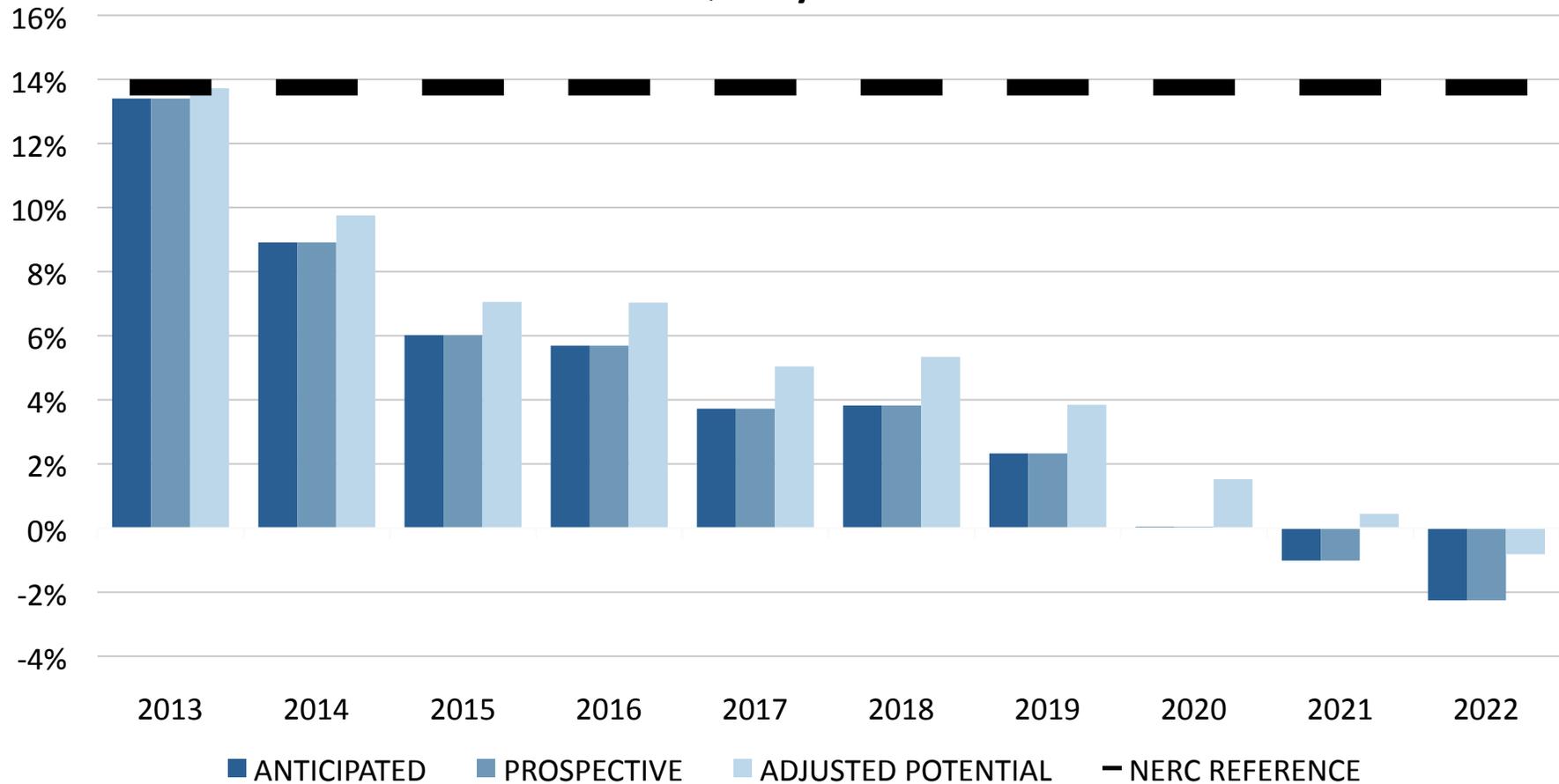


Significant Fossil-Fired Generator Retirements Over Next Five Years

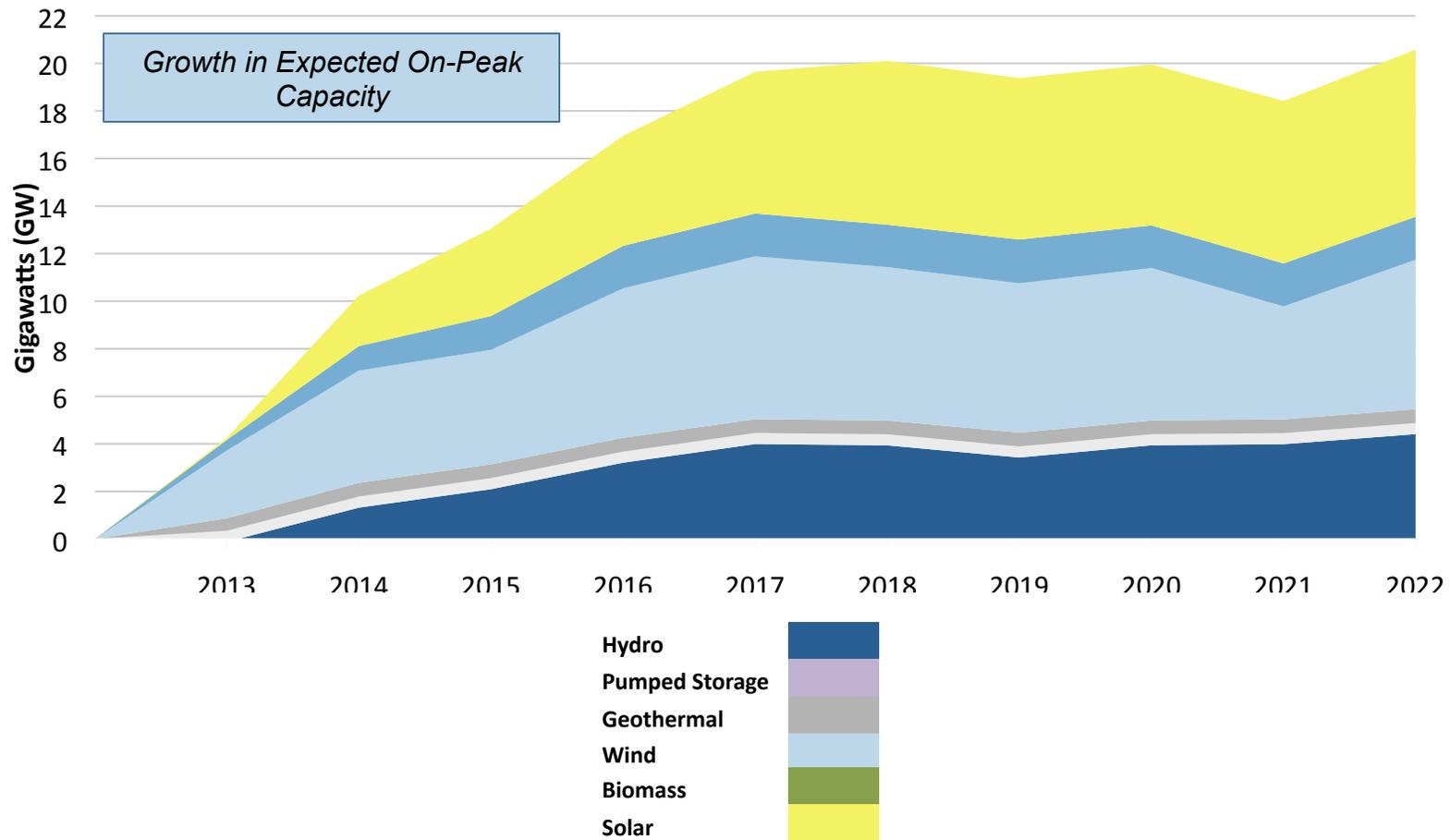
- Cumulative retirements between 2012 and 2022
- Slightly larger impacts than the 2011 generator retirement study
- On pace with actual announcements



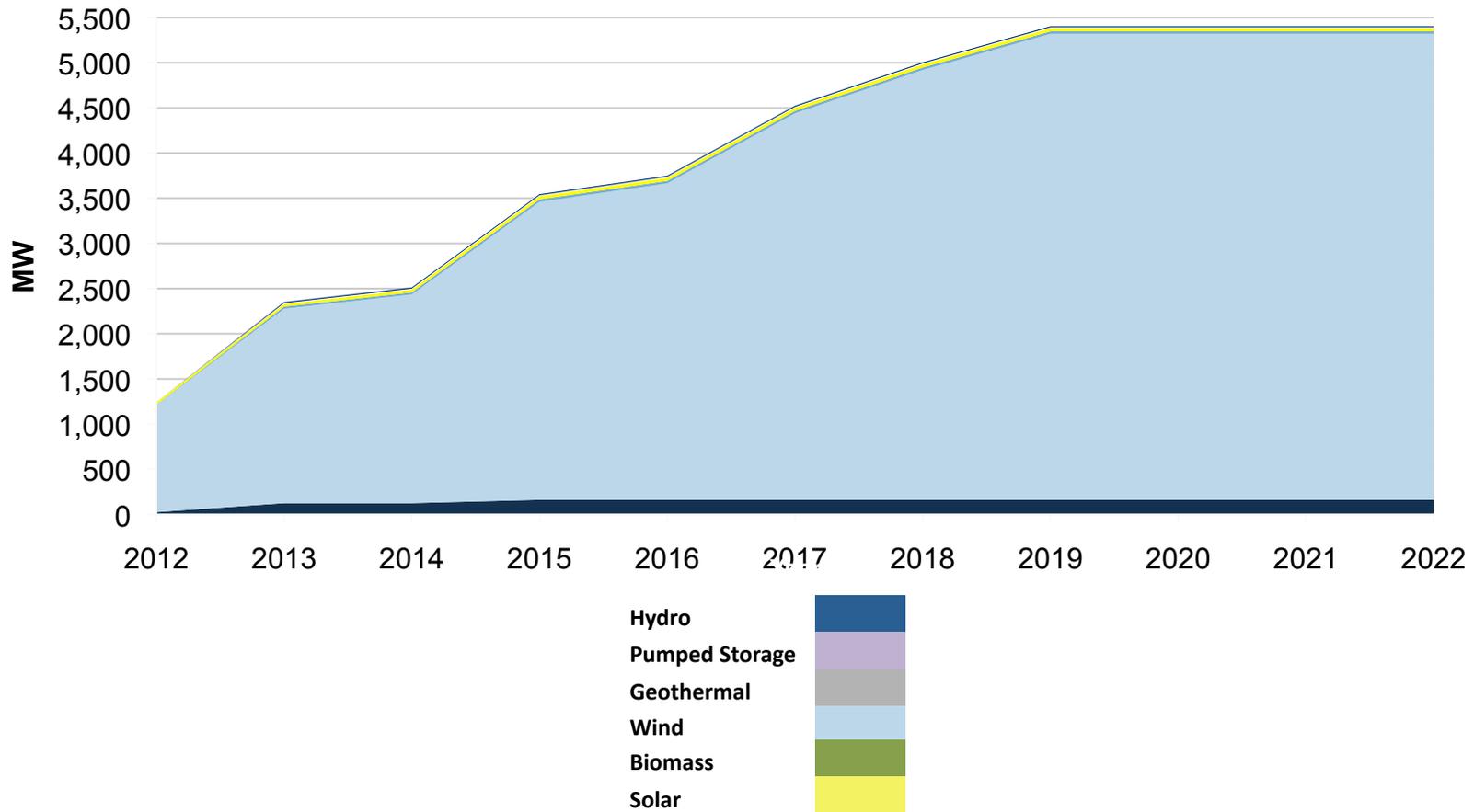
Increased Risk of Capacity Deficiencies in ERCOT; More Resources are Quickly Needed



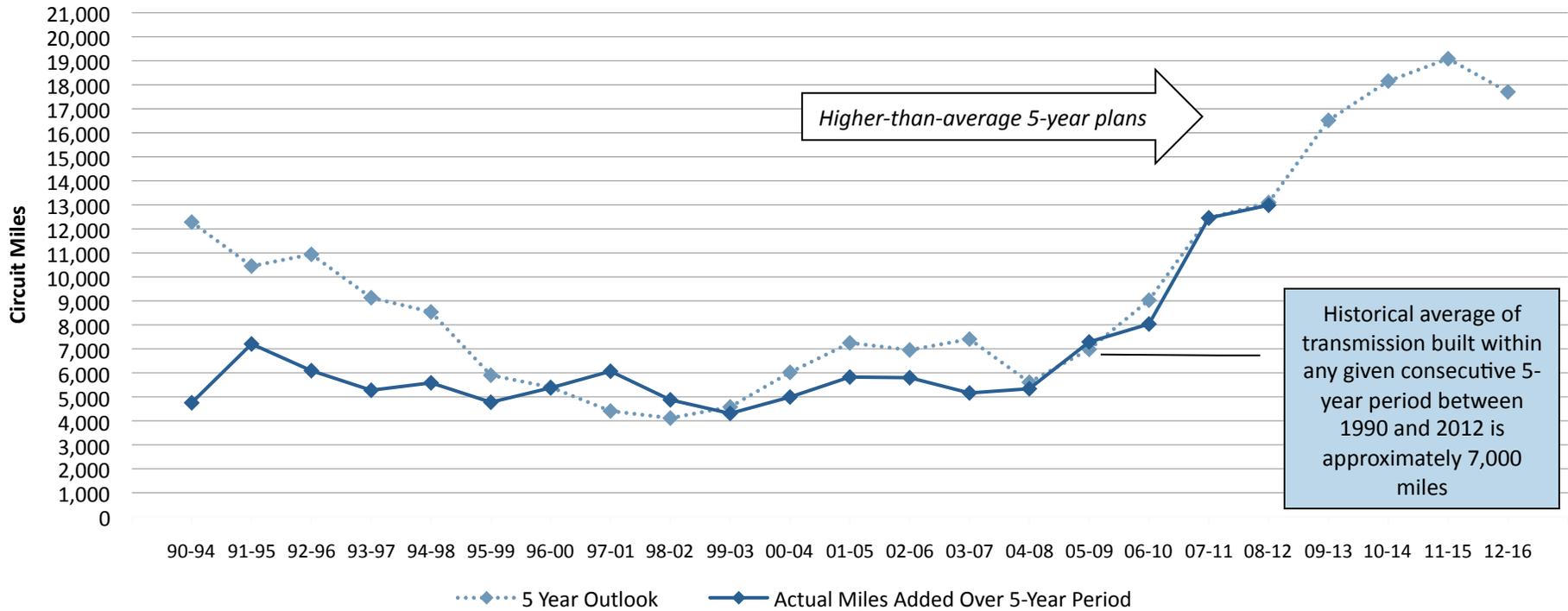
**NERC-WIDE: Renewables Represent Largest Growth of Installed Capacity
Introducing New System Planning and Operational Challenges**



For the Northwest, Future Capacity is Largely Wind Resources—Added to the Existing Hydro Energy Sources, Probabilistic Energy-Focused Metrics Provide Basis for Risk-Informed Planning

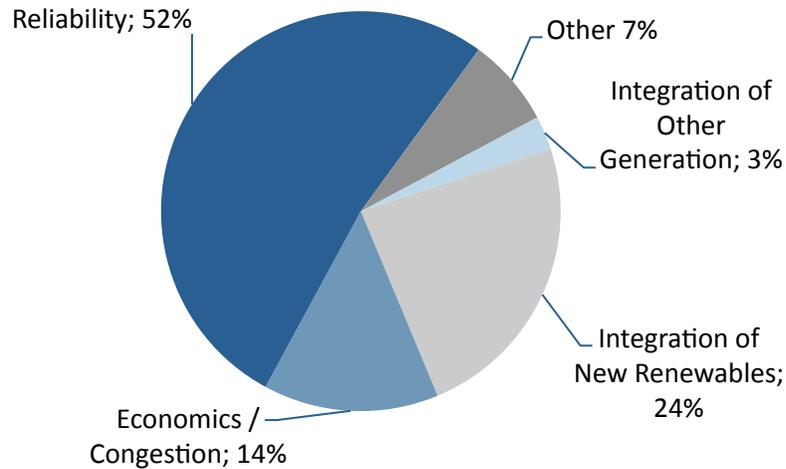


Overall Growth of Transmission Infrastructure Responding to Increased Plans to Integrate and Deliver New Resources

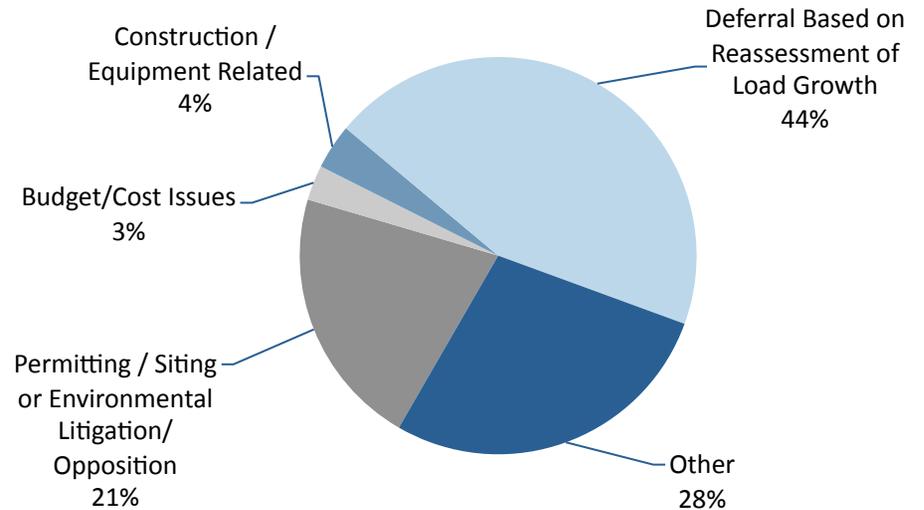


Overall Growth of Transmission Infrastructure Responding to Increased Plans to Integrate and Deliver New Resources

Drivers for New Transmission



Causes of Delays and Deferrals



- Common-mode failures and contingencies (beyond N-1)
 - Increasing variable generation
 - Significant system dynamics
 - Interruption of gas delivery / catastrophic failure of pipeline transportation and *force majeure* curtailments
- Increases in transmission limitations - utilization
- Fundamental generation-mix and load characteristics changes
- Deterministic-based metrics – assessments insufficient
- Re-evaluating framework for reliability planning criteria
 - Loss-of-Load and “1 in 10”
 - Energy Dominated Regions

- Generation & Transmission Reliability Planning Models Task Force (GTRPMTF) organized in January 2009
 - Composite G&T modeling methodology for assessing resource adequacy
- Successful execution of a long-term probabilistic-based reliability assessment
 - Significant step forward in determining future bulk system reliability
 - Aligned with resource/supply, transmission, and load characteristics
 - Framework for probabilistic reliability indices (EUE, LOLH)
 - Probabilistic-based work products/deliverables
- Pilot completed last year; First results in June 2013

Create widely recognized framework that expands insights of bulk performance and relevant assessments that reflect system characteristics



Questions and Answers