NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Resilience Framework

Mark Lauby, Senior Vice President and Chief Reliability Officer
Energy Information Administration Energy Conference
June 4, 2018

RELIABILITY | ACCOUNTABILITY




About NERC: Mission

To assure the effective and efficient reduction of risks to the reliability and security of the grid

- 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 Electric Reliability Organization (ERO) to regulators in the United States (Federal Energy Regulatory Commission) and Canada (National Energy Board and provincial governments)

Framework

- NERC work and NERC/DOE collaboration recognized in Grid study
- NERC's Reliability Issues Steering Committee tasked to develop framework for resilience
- Develop common framework, understanding, and definition of the key elements of bulk power system (BPS) resilience
  - National Infrastructure Advisory Council's (NIAC) resilience framework
    - Robustness, Resourcefulness, Rapid Recovery, Adaptability
  - Adequate Level of Reliability definition and technical report

Inputs

- Understand how key elements of bulk power system resilience fit in the existing ERO framework
- Identified current NERC activities within the NIAC framework
- Evaluate whether additional steps are needed to address key elements of bulk power system resilience within the ERO
- Discussed at NERC's February 2018 Member Representatives Committee meeting
- Regional Transmission Organization/Independent Service Operator FERC filing
- Standing Committees (i.e. Planning, Operating, Critical Infrastructure, Standards, etc.)

Understanding and Defining Resilience

- NIAC's resilience framework with adjustments in red:
  - Robustness – to absorb shocks and continue operating
  - Resourcefulness – detect and manage a crisis as it unfolds
  - Rapid Recovery – get services back as quickly as possible in a coordinated and controlled manner
  - Adaptability – incorporate lessons learned from past events to improve resilience

Activities Supporting Framework

- Robustness
  - Risk, event, and performance monitoring
  - Reliability and emerging risk assessments
  - Technical committee work, including special projects
  - System operator training, certification, and credential maintenance
  - Reliability Standards and Reliability Guidelines
  - E-ISAC information-sharing programs
- Resourcefulness
  - Situational awareness and industry coordination
  - Government coordination
  - Cross-sector information sharing
  - Reliability Standards Functional Model and Reliability Guidelines
  - System operator training, certification, and credential maintenance

Activities Supporting Framework

- Rapid Recovery
  - Situational awareness and industry coordination
  - Government coordination
  - Cross-sector information sharing
  - Reliability Guidelines
  - System operator training, certification, and credential maintenance
- Adaptability
  - Reliability and emerging risk assessments
  - Event analysis, forensics, and lessons learned
  - Reliability Guidelines
  - System operator training, certification, and credential maintenance
  - Periodic reviews

Additional Activities Suggested by Standing Committees

- Revisions to standards process templates and training materials
- Increased communication of NERC's ongoing resilience and risk mitigation efforts
- Compliance monitoring focus on standards supporting resilience
- Recommend additional focus on:
  - Operational impacts of distributed energy resources
  - Fuel assurance and security to promote resilience
  - Quality of emergency preparedness

NERC's Definition of Reliability

- NERC's view of reliability for the bulk power system consists of two fundamental and aspirational concepts:
  - ***Adequacy,*** *the ability of the electric system to supply the aggregate electric power and energy requirements of electricity consumers* ***at all times****, taking into account scheduled and reasonably expected unscheduled outages of system components.*
  - ***Operating reliability,*** *the ability of the electric system to* ***withstand sudden disturbances*** *such as electric short circuits or unanticipated loss of system components.*

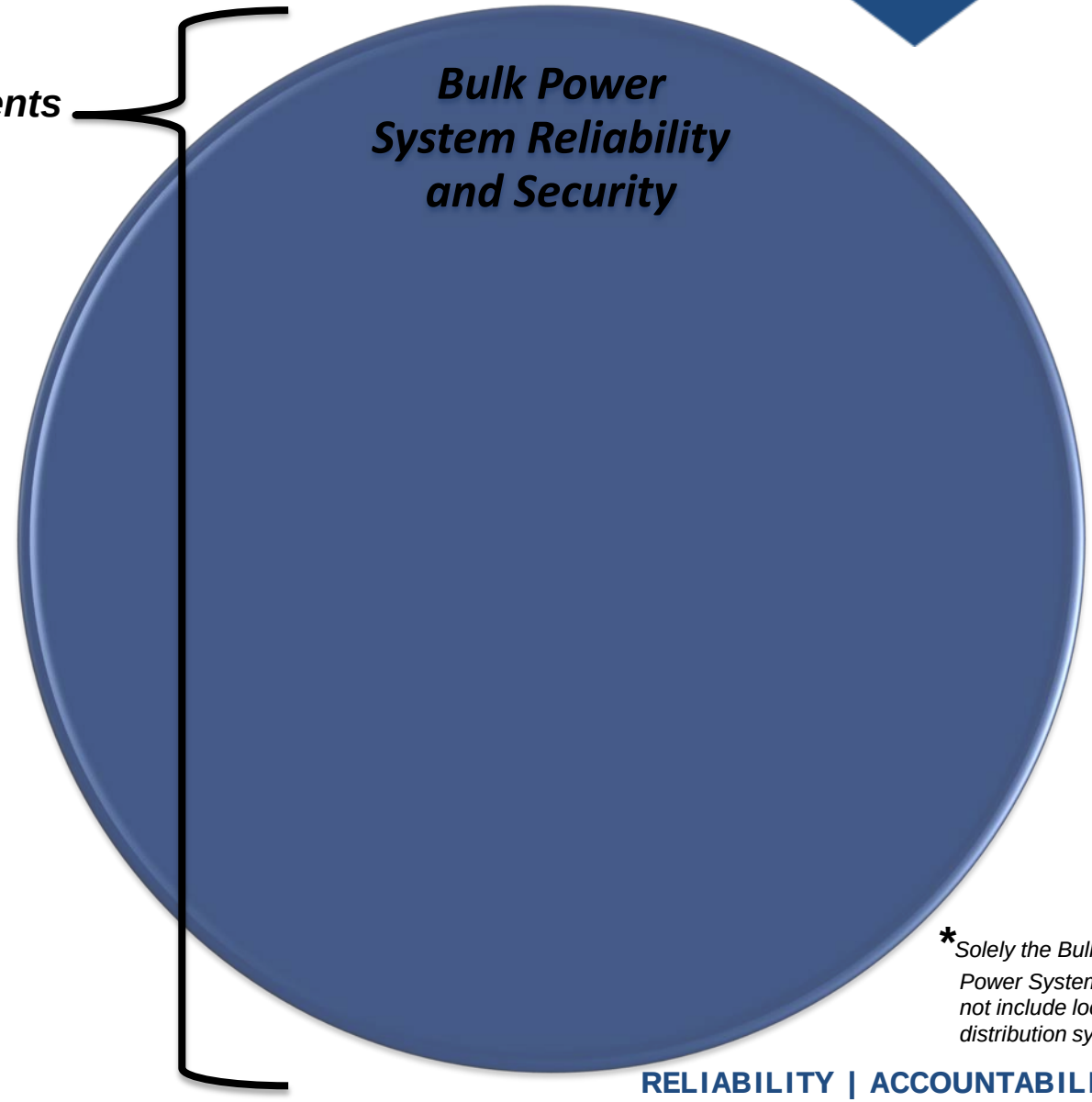
Resilience is a Characteristic of a Reliable System

NERC Reliability Assessments and Performance Analysis

- ***Reliability Assessments***
- ***System Analysis***
- ***Events Analysis***
- ***Performance Analysis***
- ***Situational Awareness***

Operator Training

E-ISAC



*Solely the Bulk Power System. Does not include local distribution systems.

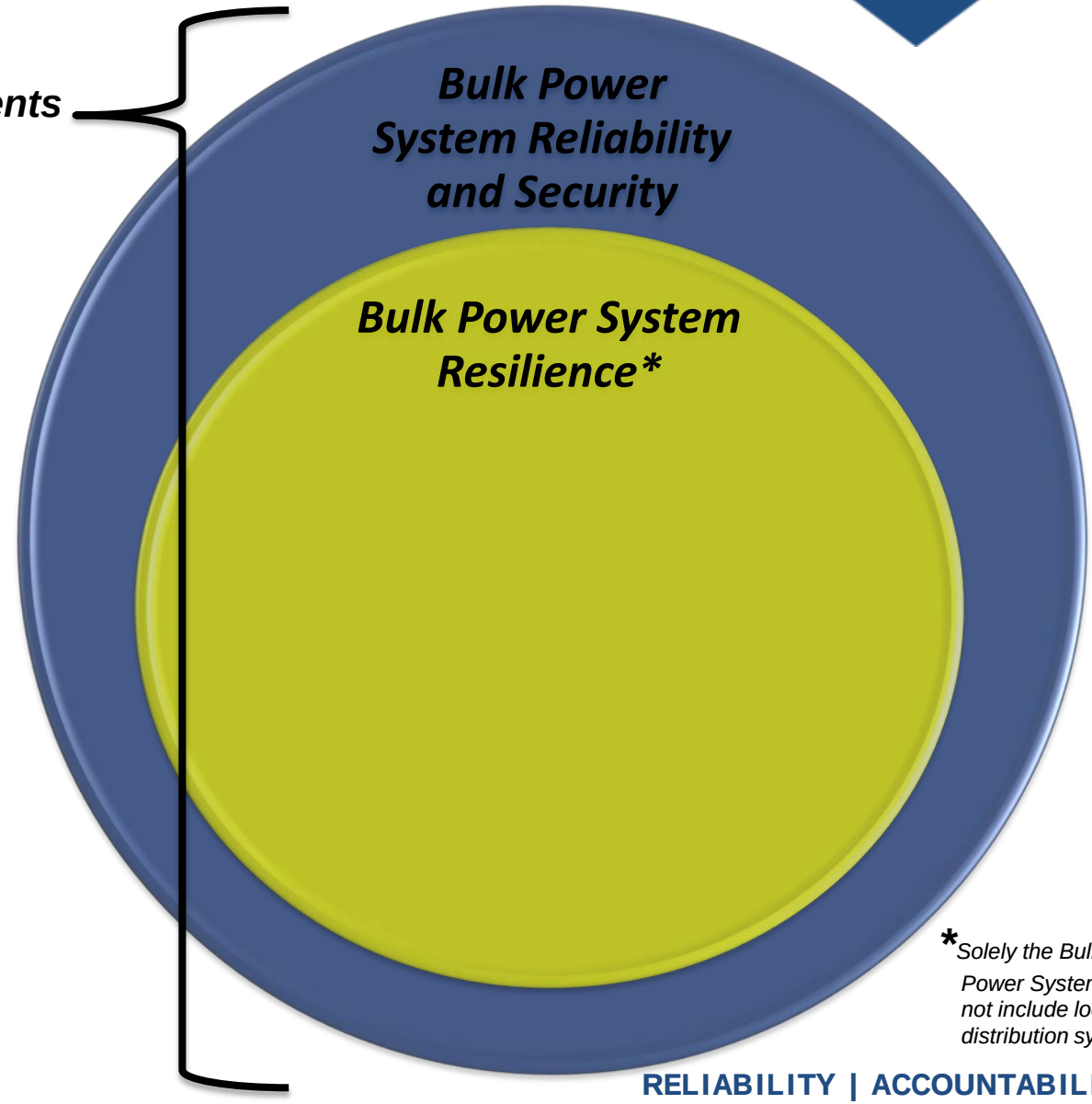
Resilience is a Characteristic of a Reliable System

NERC Reliability Assessments and Performance Analysis

- ***Reliability Assessments***
- ***System Analysis***
- ***Events Analysis***
- ***Performance Analysis***
- ***Situational Awareness***

Operator Training

E-ISAC



**Solely the Bulk Power System. Does not include local distribution systems.*

Resilience is a Characteristic of a Reliable System

NERC Reliability Assessments and Performance Analysis

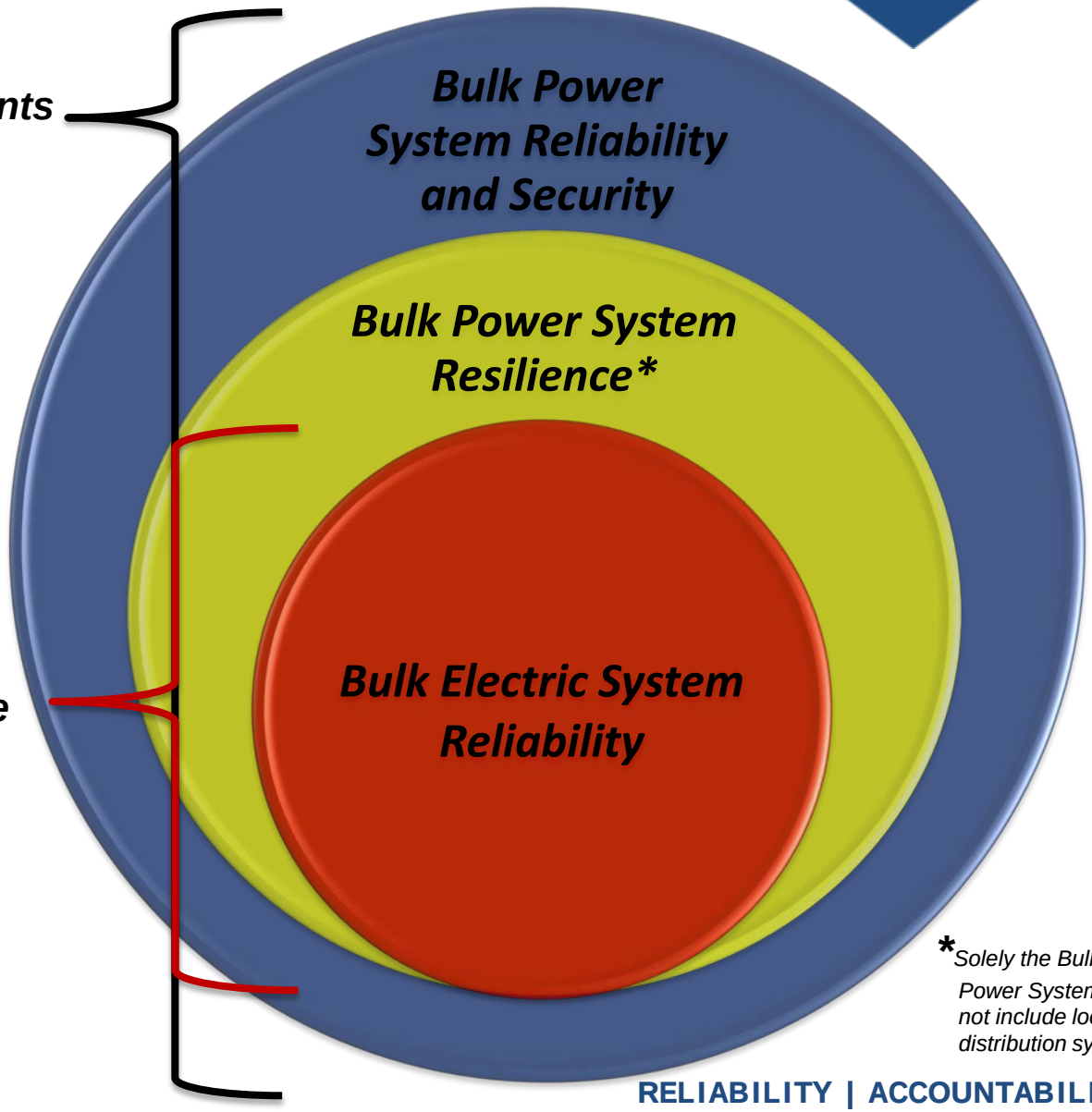
- *Reliability Assessments*
- *System Analysis*
- *Events Analysis*
- *Performance Analysis*
- *Situational Awareness*

Operator Training

E-ISAC

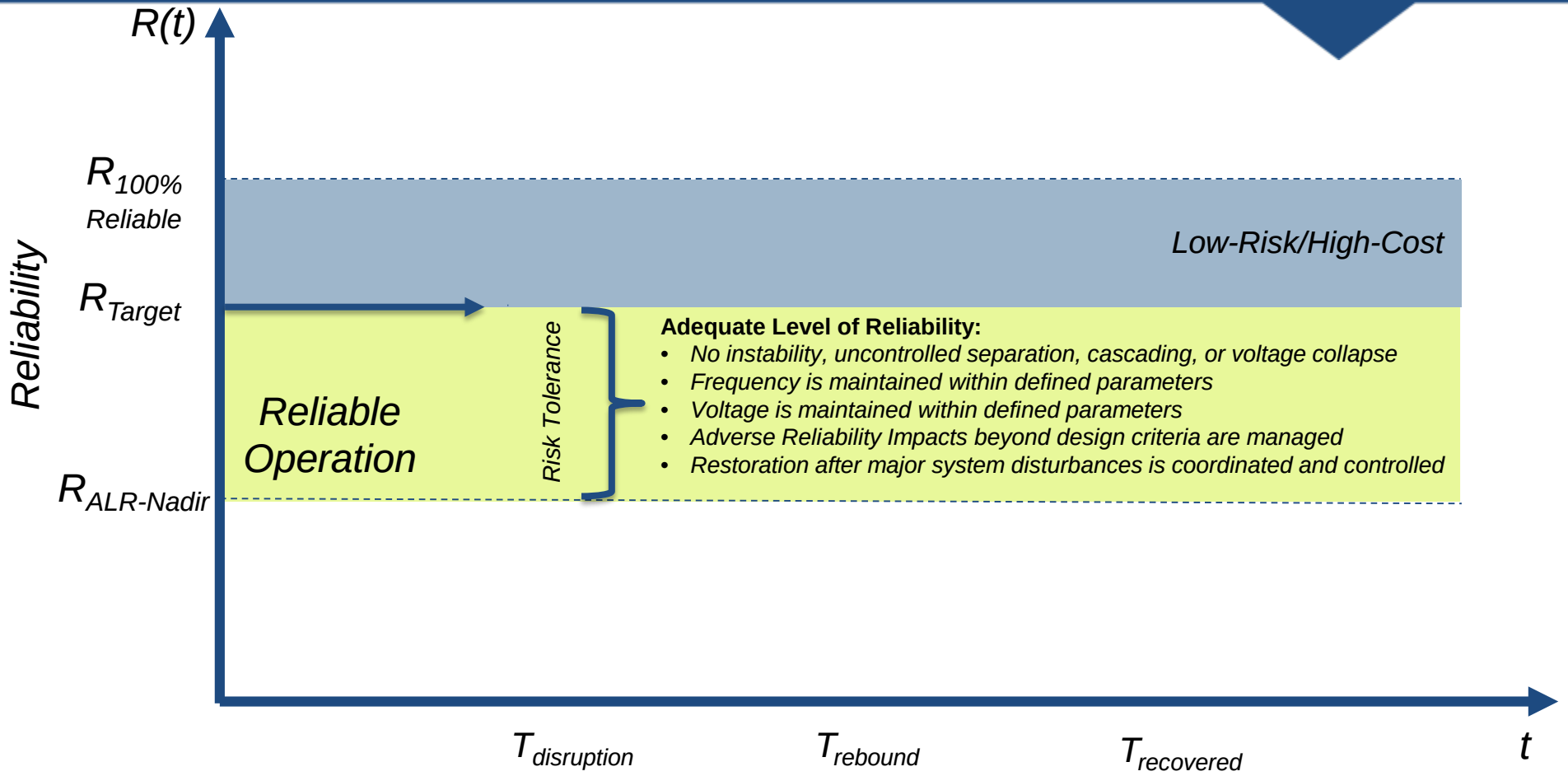
NERC Reliability Assurance

- *Standards*
- *Compliance*
- *Enforcement*
- *Registration*
- *Certification*

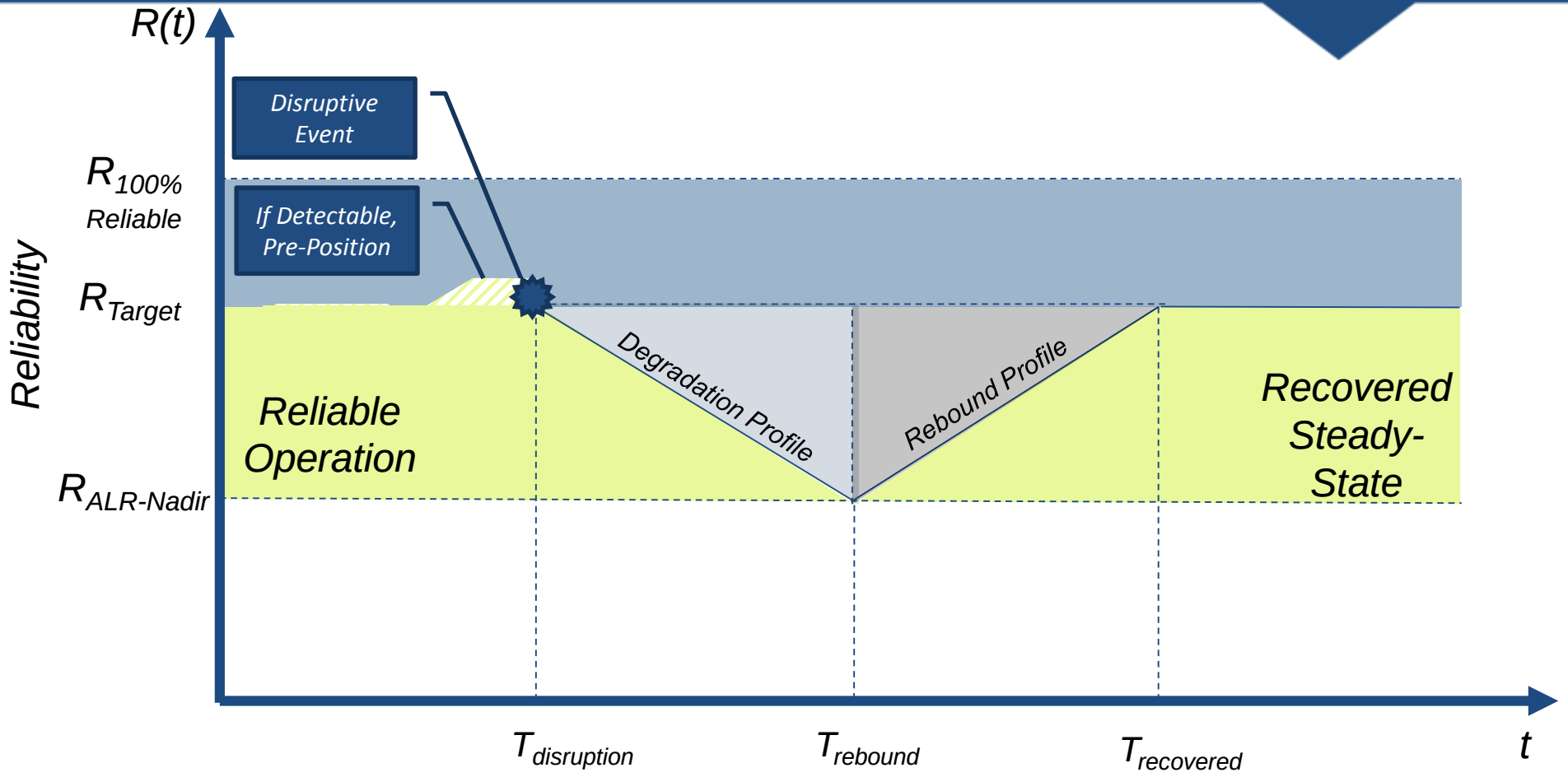


**Solely the Bulk Power System. Does not include local distribution systems.*

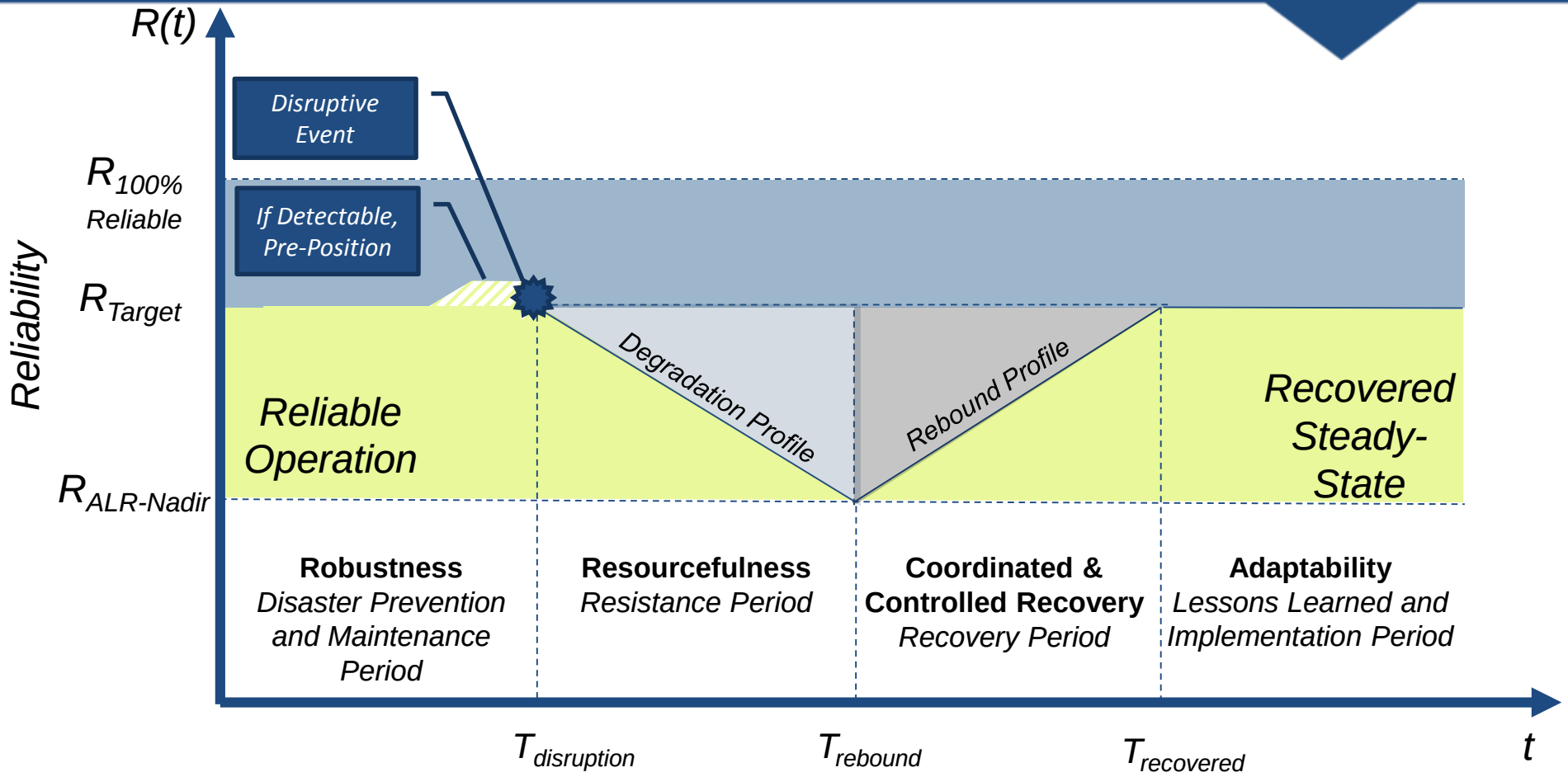
Adequate Level of Reliability



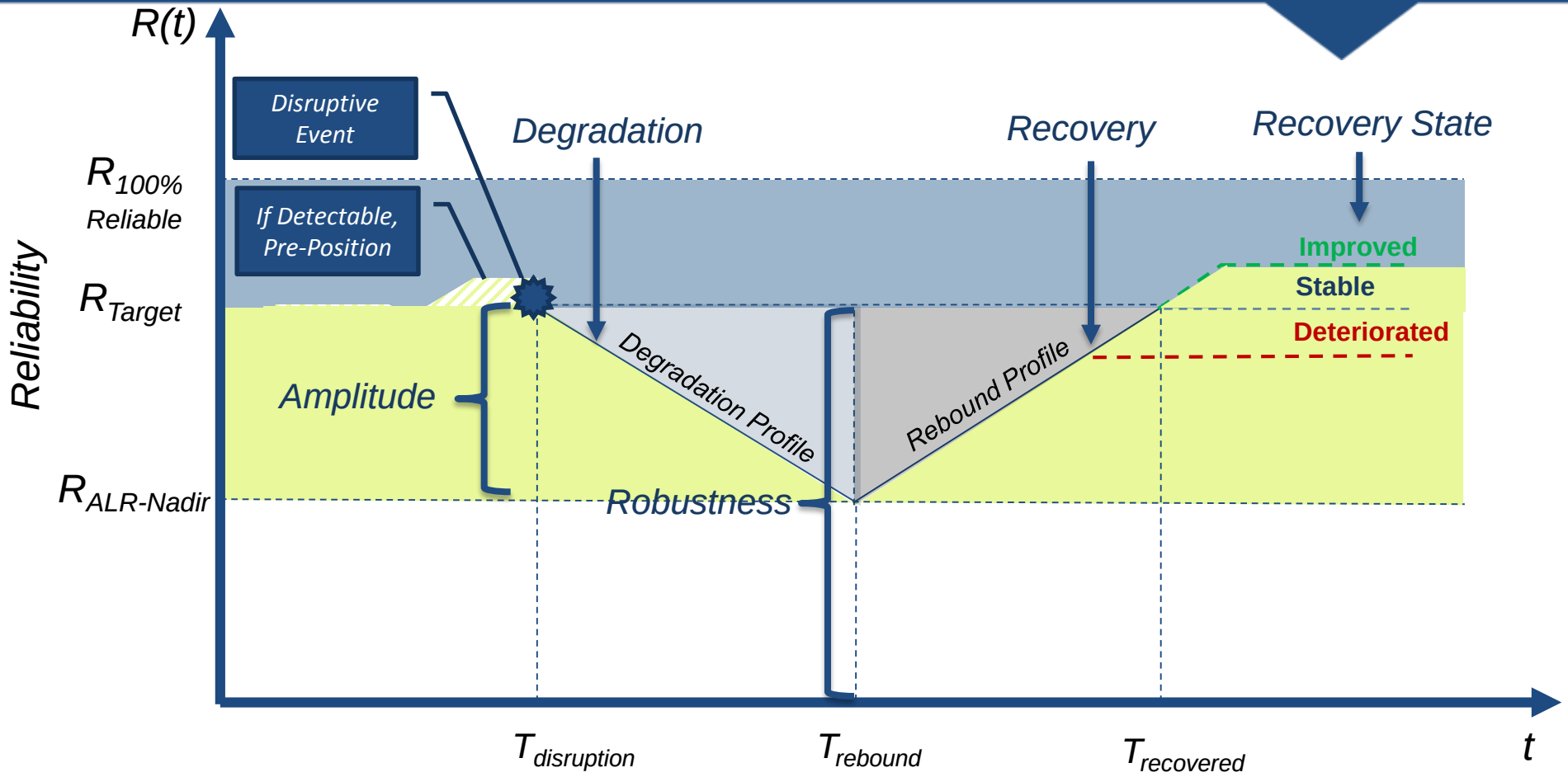
Disruption on BPS



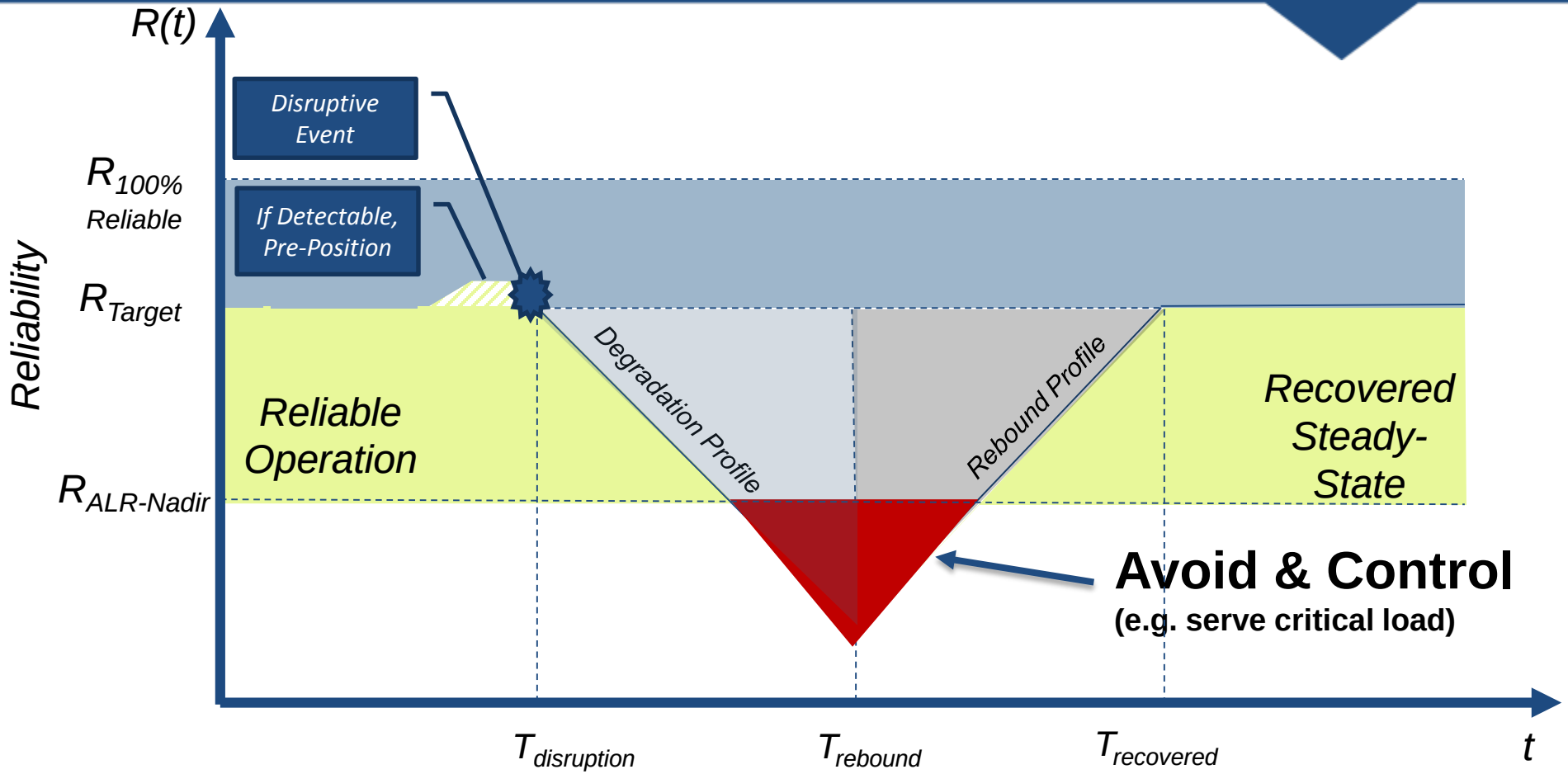
Resilience Framework



Resilience Indicators



Ensuring Adequate Level of Reliability



Next Steps

- Await reply comments from industry on FERC's resilience proceedings
- Monitor FERC's response to comments
- Discuss suggested additional activities
- Present recommendations to NERC's Board of Trustees in August and discuss additional work

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Questions and Answers

Resilience Indicators

- **Robustness:** the measured ability to withstand certain threats
- **Amplitude:** a measure of the impact on BPS performance
- **Degradation:** a measure of a change in system response with respect to an impact of varying amplitude
- **Recovery:** a measure of the rate at which the system returns (rebounds) to a normal or stable state after the disruptive event, including any preparation time
- **Recovery state:** the state of BPS performance following the recovery period.
  - Stable
  - Improved
  - Deteriorated

A Reliable System is a Resilient System

- The 2005 Federal Power Act requires NERC to develop and enforce Reliability Standards that:
  - Support reliable operations.
  - Provide for an adequate level of reliability.
- System with an adequate level of reliability is resilient
  - Industry has designed a reliable bulk power system that is robust, resourcefully operated, and rapidly recovers
  - Lessons learned are actively considered during and after an event