

ELECTRIC RELIABILITY:

Metrics and Reports in Iowa

NARUC Energy Regulatory Partnership Program

The Public Services Regulatory Commission of Armenia
and The Iowa Utilities Board



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RELIABILITY TOPICS

- State [Iowa Utilities Board (IUB)] Rules
- Reliability Metrics
- Iowa: Records Requirements
- Iowa: Annual Electric Reliability Reports (EDR)
- Iowa: Outage Reporting
- North American Electric Reliability Corporation (NERC)



STATE (IOWA UTILITIES BOARD)

[199 IAC 20.18]

- Generally, authority over electric utilities to demonstrate reliability for service to retail customers in the state.
- Utilities are to make reasonable efforts to avoid and prevent interruptions, and to restore service in shortest practicable time consistent with safety.
- T & D to be designed, constructed and maintained to reliably deliver power in the "storm and traffic hazard environment in which they are located."
- Utilities are to:
 - Keep records of interruptions on primary distribution
 - Analyze records for steps to prevent recurrence
 - Make reasonable efforts to reduce risk of future interruptions



RELIABILITY METRICS

OUR STATE RULES DEFINE ANNUAL INDICES....

- System Average Interruption Duration Index (SAIDI)

$$\text{SAIDI} = \frac{\text{Sum of All Customer interruption Durations}}{\text{Total Number of Customers Served}}$$

- System Average Interruption Frequency Index (SAIFI)

$$\text{SAIFI} = \frac{\text{Total Number of Customer Interruptions}}{\text{Total Number of Customers Served}}$$

- Customer Average Interruption Duration Index (CAIDI)

$$\text{CAIDI} = \frac{\text{Sum of All Customer Interruption Durations}}{\text{Total Number of Customer Interruptions}}$$

- Momentary Average Interruption Frequency Index (MAIFI)

$$\text{MAIFI} = \frac{\text{Total Number of Customer Interruptions}}{\text{Total Number of Customers Served}}$$



RELIABILITY RECORDS

(DIFFERENT FOR > OR < 50,000 CUSTOMERS)

For Utilities with **> 50,000 Iowa retail customers:**

- Need GIS (coordinate data) and computerized Outage Management System, for a per-customer history.
- Sortable by: State jurisdiction, operating area, substation, circuit, number of interruptions per reporting period, number of hours interruptions per reporting period.
- Records include: Outage date/time, duration, restoration date/time, number of customers out, cause, affected operating areas, circuit number(s) affected, service account number and address of each affected customer, weather at time of interruption, system components involved, whether the interruption was planned or unplanned.
- Also keep descriptor codes for each outage for: cause, weather, isolating device, and failed equipment.
- Retain records for 7 years.



RELIABILITY RECORDS

[DIFFERENT FOR > OR < 50,000 CUSTOMERS]

For other Utilities:

- Must have records to CALCULATE the average interruptions per customer by category of cause: power supplier, major storm (snow, ice or wind loads exceeding design), scheduled, and all other (including equipment failure and human error).
- Should use U.S. Rural Utility Service (RUS) cause codes and subcategories.
- Sufficient data to calculate SAIFI, SAIDI, CAIDI in the two cases "with major storms" and "without major storms."
- Retain records for 7 years.



IOWA ANNUAL ELECTRIC RELIABILITY REPORTS

[IF > 50,000 RETAIL CUSTOMERS, DUE MAY 1, AND TO INCLUDE ...]

Reliability Performance:

- Description of Service Area (of interest, for example, because rural areas may have many more miles of overhead low voltage lines per customer).
- Calculations of SAIFI, SAIDI, and CAIDI as a function of: rural/urban, operating areas (if applicable), with and without storms, and by substation/Generation/Transmission.
- A 5-year history of those calculations.
- MAIFI for 5 years.



Sample Reliability Report Table

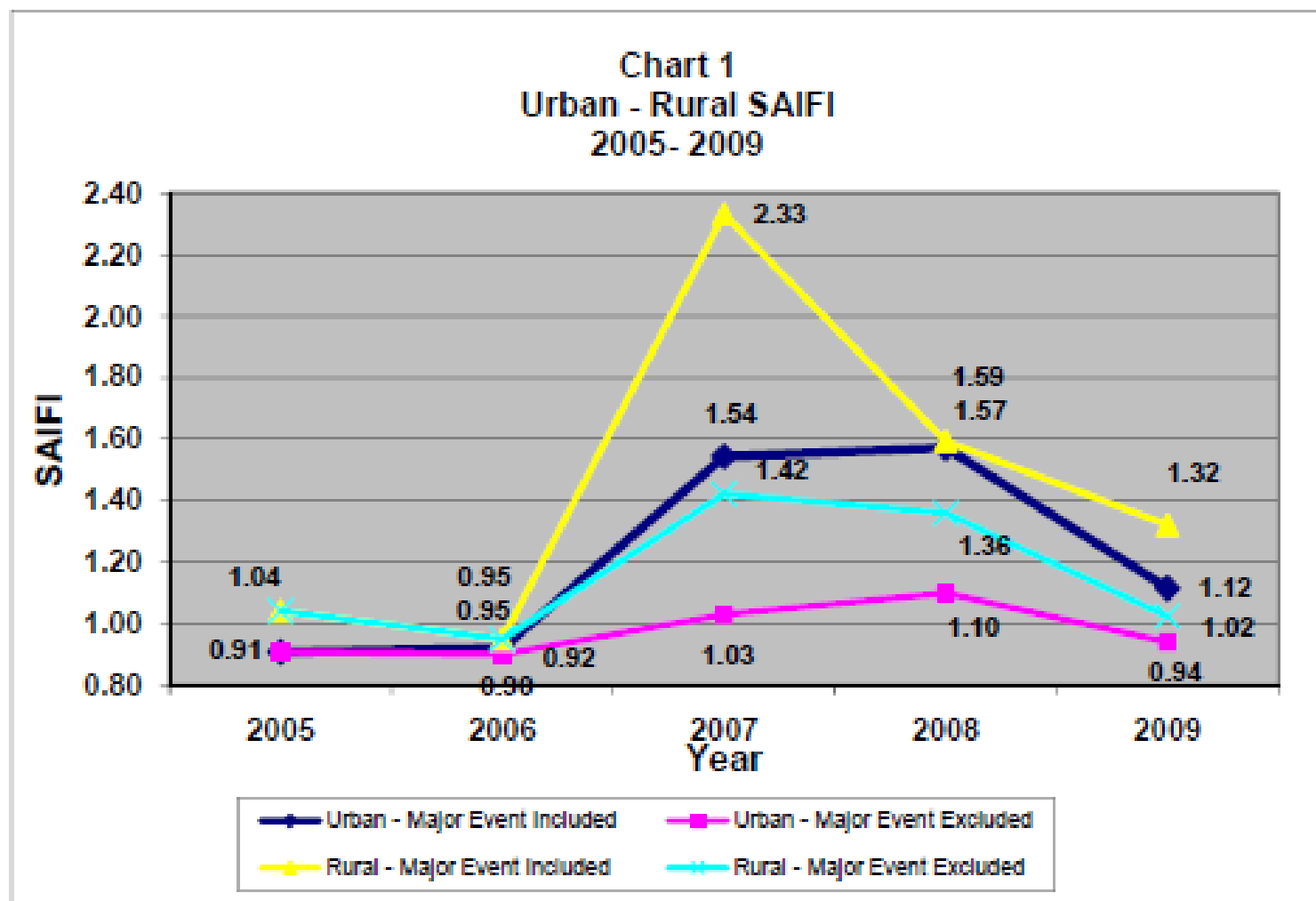
2005 – 2009 MidAmerican Iowa Operating Area Reliability Indices

Territory	Year	SAIFI		SAIDI		CAIDI	
		Major Event		Major Event		Major Event	
		Included	Excluded	Included	Excluded	Included	Excluded
Urban	2009	1.12	0.94	137.22	92.40	123.02	98.39
	2008	1.57	1.10	264.75	112.08	168.43	101.94
	2007	1.54	1.03	295.76	89.39	191.64	86.82
	2006	0.92	0.90	87.30	74.55	95.18	82.88
	2005	0.91	0.91	81.20	81.20	89.49	89.49
Rural	2009	1.32	1.02	225.24	121.18	170.49	118.37
	2008	1.59	1.36	256.24	154.69	160.80	113.78
	2007	2.33	1.42	895.09	162.39	383.94	114.20
	2006	0.95	0.95	84.29	84.03	88.74	88.50
	2005	1.04	1.04	111.46	111.46	106.99	106.99

* SAIFI = Frequency of outages. SAIDI = Duration an average customer is without power.
CAIDI = Duration of average outage. See formal definitions on other slide.



Sample Reliability Report - SAIFI History



Reliability Reports

[> 50,000 RETAIL CUSTOMERS (cont ...)]

Customer Outages:

- Tables and graphs with and without storms

Major Event Summary:

- By area, customer, customer minutes, and damage and damage costs

Transmission and Distribution information:

- Circuit miles of each by Voltage
- Capital Expenditures, Maintenance, and Plans



IOWA ANNUAL ELECTRIC RELIABILITY REPORTS

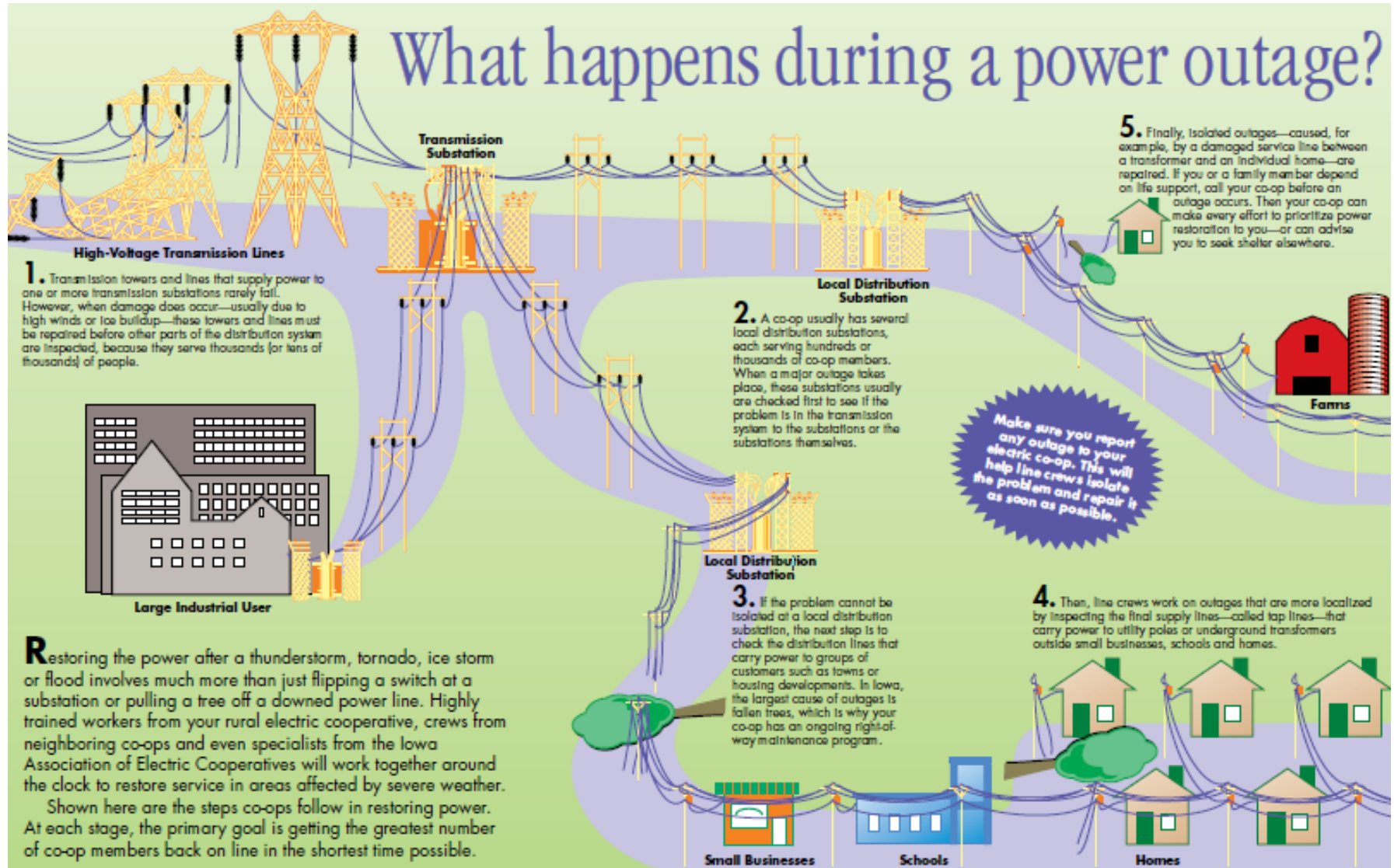
[OTHER UTILITIES, DUE JULY 1 FOR PRIOR YEAR, AND TO INCLUDE...]

- Reliability Programs:
 - Tree trimming
 - Animal contact reduction (if applicable)
 - Lightning outage mitigation
 - Other
- Description of ability to track & monitor interruptions.
- Description of how utility communicates reliability plans with customers.
- Reliability Report to the utility's governing board by April 1 including:
 - Measures for SAIFI, SAIDI, CAIDI, with and without storms



SAMPLE CUSTOMER COMMUNICATION

[IOWA ASSOCIATION OF ELECTRIC COOPERATIVES (IAEC)]



IOWA ELECTRIC OUTAGE REPORTING

[199 IAC CHAPTER 20.19]

- Required for a "major event," defined as wind speed > 90 mph (144 km/hr), ½ inch (1.27 cm) of ice and wind > 40 mph (67 km/hr), 10% of customers out for more than 5 hours, or 20,000 customers in a metropolitan area out for more than 5 hours.
[199 IAC 20.18(4)]
- Reporting supports:
 - Utility accountability for reliability expectations
 - Awareness of critical or high-profile outages
 - IUB information prior to customer complaints
 - IUB media response if applicable
 - IUB and state agency assistance and coordination for severe events (Ice Storms 2007, Floods of 1993 and 2008)
- IUB Duty Officer carries 24/7 Pager/Blackberry.

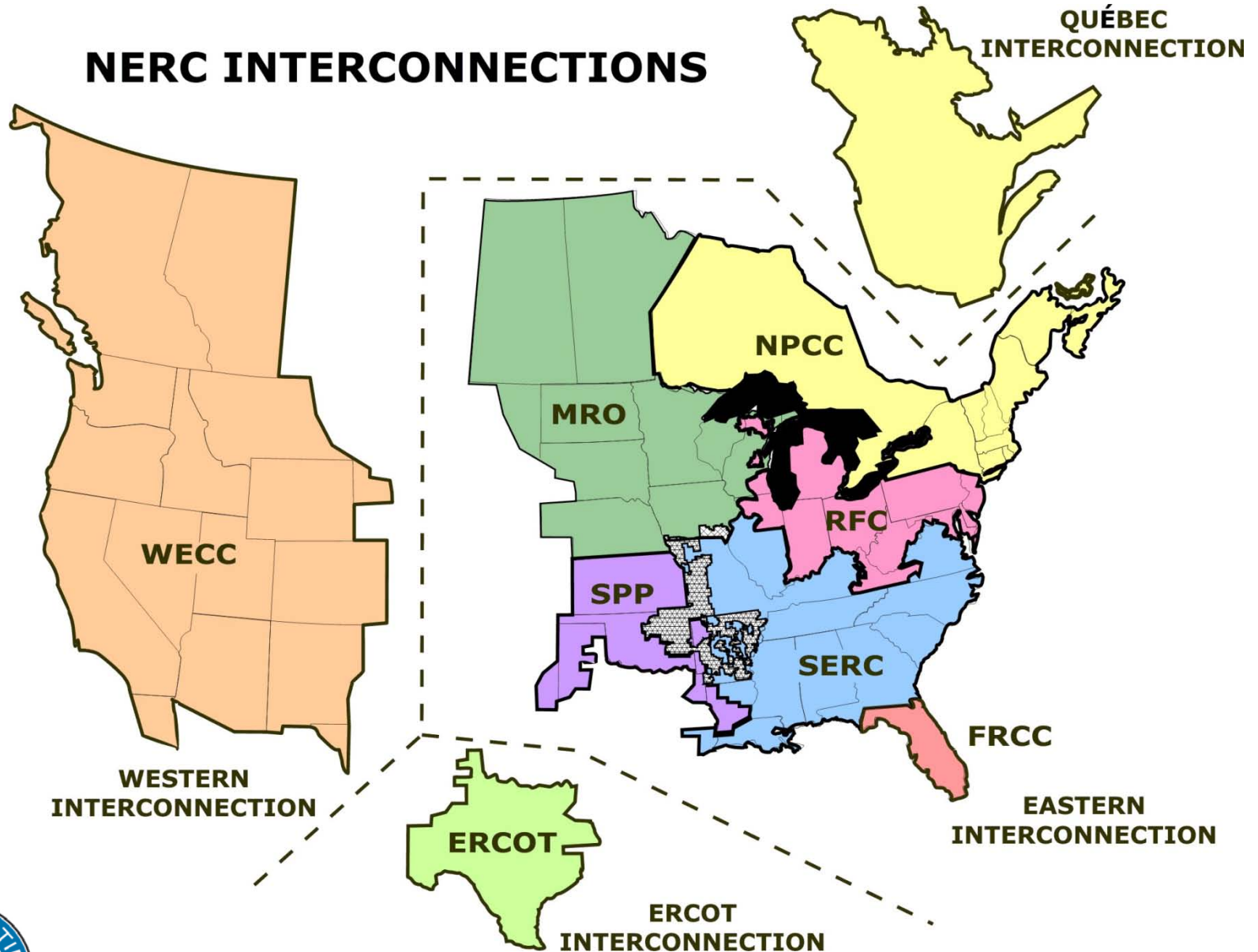


NERC/FERC EVENT REPORTING

- Following August 14, 2003, East Coast blackout and security concerns, the Federal Energy Policy Act (EPACT) of 2005 gave the FERC new and much greater reliability authority for the Bulk Power System.
- NERC formerly advisory/guidance, now is the country's NERC-approved Electric Reliability Organization (ERO).
- NERC is "North American" including Canada.
- Regional Reliability Organization (RRO) subordinate to NERC.
- RTOs, utilities subordinate to RROs.
- Event reporting to NERC required and under revision. NERC states the reporting is also to encourage a learning organization and sharing lessons learned across the industry.
- Increasing detail and granularity of reported information is required ... Self-reporting intended to earn some leniency in any applicable penalties ...



NERC INTERCONNECTIONS



SOME NERC STUDIES RELATED TO RELIABILITY

- Frequency Response.
- Reliability Impact of Variable Generation.
- Impact of Environmental Regulations on Reliability
 - U.S. EPA Regulations sometimes described as "death by a thousand cuts" for coal, particularly older coal.
- Security:
 - For example: Intentional Cyber attack, Geomagnetic Disturbance, Natural Disaster.
- Many studies and papers by various entities, but results and conclusions that are approved by NERC may have special and influential meaning.



QUESTIONS?



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