Commissioner Jeff Davis

Missouri Public Service Commission

ACERCA/NARUC

Transmission and Distribution Service Quality

August 2009

Missouri Public Service Commission

- The Missouri Public Service Commission was established by the State Legislature in 1913 to regulate railroad pricing.*
- Today, the MO PSC regulates investor-owned electric utilities, natural gas companies, water and sewer systems and more than 100 types of utility services.

*Revised Statutes of the State of Missouri Chapter 386 and Chapter 393

Missouri Public Service Commission

- The Missouri Public Service Commission is based in the Missouri State Capital.
- It employs 200 engineers, attorneys, judges, accountants and analysts to carry out its tasks.
- Each year, more than 1,000 cases are filed with the Commission.
- Cases range from service or billing complaints for individual consumers to major rate cases involving hundreds of millions of dollars.

Regulatory Approaches

- State and Federal Regulatory Systems are modeled after legal frameworks for general governmental roles in the U.S.
  - The U.S. Government is responsible for regulating systems that cross state boundaries or that affect multi-state areas or the entire nation. .
  - States are responsible for regulating utilities within their state boundaries.

Regulatory Jurisdiction:

- United States Government Regulates Safety & Reliability:
  - Hydroelectric Dams
  - Nuclear Reactors
  - Interstate Transmission Systems (69kV or larger)
- States Regulate Prices:
  - Generation Facilities
  - Distribution Systems (69kV or smaller)
  - Reliability/Quality of Service/Rates

The Missouri Commission's Authority to Investigate & Monitor:

- The Commission has independent authority to investigate electric utilities in all matters and to even search records out of state. Failure to comply subjects the utility to our penalty authority.
- Customer feedback is our primary source of information about outages, reliability and service problems. We employ seven customer service representatives who take phone calls, receive e-mails, and attend meetings of local government agencies, civic groups and churches.

The Commission's Ability to Monitor & Enforce Standards

- The Commission employs a team of engineers, three teams of auditors, economists and other experts who monitor all aspects of construction and financing on new projects and renovations.
- In some cases, it is a best practice to hire a full-time construction monitor for a large project.
- If there are problems, the Commission staff will bring a complaint or seek to deny the expenses when the utility files for cost recovery.

The Missouri Commission's Penalty Authority:

The Missouri Commission is authorized to seek penalties for "violations or failure to comply" with the Missouri Constitution, state laws and Commission orders in whole or in part. State law requires utilities to maintain "safe and adequate service."

Every violation is subject to a penalty of no less than one hundred dollars ($100.00) per day or no more than two thousand dollars ($2,000.00) **for each "offense**."

Penalties are cumulative and each day's violation constitutes **a new "offense."** Thus, one violation occurring every day for a year could lead to a penalty of seven hundred thirty thousand dollars ($730,000 per year for each violation).

The Commission determines the amount of penalty and the number of penalty actions to be brought, but we have to bring the action in the civil courts.

Source: Missouri Revised Statutes Sections 386.570 through 386.600.
http://www.moga.mo.gov/statutes/c300-399/3860000570.htm

Penalties: Where does the money go?

- All fines, penalties and forfeitures are required by law to go to either the state or county school fund used to educate elementary and secondary school children.
- However, if the Commission and the utility reach a “settlement” or agreement, they can agree to set aside funds for other purposes. Examples are: assisting low-income customers, building infrastructure to develop commerce and reparations for customer losses.

The Reliability Challenge

No matter how well electric distribution and transmission systems are designed and maintained, all systems will be subject to power outages.

Preventing the Preventable

- In recent years, Missouri has suffered extended power outages due to damaging storms that affected millions of Missouri utility consumers.

Managing the Manageable: Missouri's Three-Stage Approach

- To help reduce the frequency and length of power outages, the Missouri Public Service Commission adopted a three-stage approach to improve reliability and reduce power outages.
  - 1. Vegetation Management (4 CSR 240-23.030)
  - 2. Infrastructure Inspection (4 CSR 240-23.020)
  - 3. Reliability Reporting (4 CSR 240-23.010)

Copies of rules are available at
http://sos.mo.gov/adrules/csr/current/4csr/4c240-23.pdf

Vegetation Management

Regular Trimming Cycle

- Missouri is a heavily forested state. Vegetation is a big contributor to storm outages, even in cities.
- The PSC adopted a rule requiring utilities to trim vegetation along distribution systems on regularly scheduled cycles.
- Utilities hire local crews that work year-round to keep trees and brush trimmed a safe distance away from power lines.

Standard Distances Between Power Lines and Vegetation

Clearance from trees	Rate of Growth	Primary Voltage (2-25 KV)	34 KV	69 KV	161 KV	345 KV
SIDE	Slow Fast	8 12	10 15	10 10	25 25	35 35
OVER	Slow Fast	(a) (a)	None None	None None	None None	None None
UNDER	Slow Fast	6 8	10 12	10 10	15 15	20 20

Distances, shown here in feet, are established by the voltage of the line and the growth rate of vegetation

Transmission Right of Way

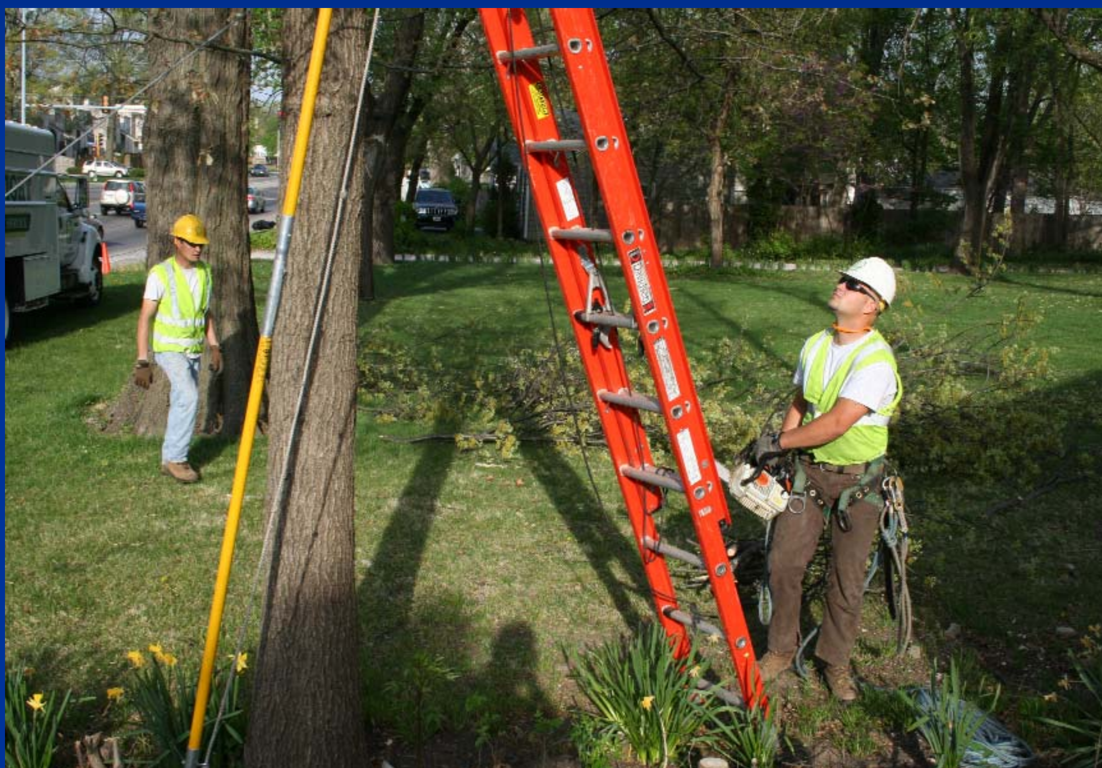
Transmission lines with capacity of 345kV or more are considered part of the national transmission grid and are regulated by the FERC. In 2003, a major blackout in the U.S. and Canada was caused by a tree contacting a line. This resulted in new vegetation standards that require minimum 100 ft. distances between these lines and all vegetation.

In addition, if growth beyond this distance poses a hazard, it will be removed to help reduce potential outages

Standardized Vegetation Management Plans

- Standardized plans must take into account:
  - Vegetation growth rate at relevant sites;
  - Voltage of the conductor – higher voltage requires greater distance;
  - Sag of the conductor due to wind and temperature changes;
  - Legal rights involved in removing vegetation from private property.

Independent Contractors



Companies hire and train independent contractors who carry out vegetation management tasks on set schedules. This helps create local jobs, reduces costs of transporting workers and equipment and helps involve local residents who are familiar with the region and others who live in the area.

Trained Arborists

Utilities are required to use a trained arborist to develop best-practices for vegetation management and to oversee local contractors.

This helps protect the environment and gives the companies the resources and flexibility to properly maintain transmission and distribution clearances.

Infrastructure Inspection Standards

The second rule requires each utility to develop and carry out detailed plans to regularly inspect and report on the conditions of electric infrastructure including poles, lines and all transmission and distribution equipment. These include "patrol" inspections and "detailed/intrusion" inspections. Reports of inspections must be filed annually with the Commission.

Types of Required Inspections

- Patrol Inspections:
  - Simple, visual inspections to detect obvious structural problems and hazards
- Detailed Inspections:
  - Specific inspections in which individual pieces of equipment and structures are thoroughly examined, both visually and through diagnostic testing.
- Intrusive Inspections:
  - Inspections that require moving soil, taking samples for analysis or using sophisticated diagnostics beyond visual inspections and normal instrument readings.

Infrastructure Inspection Cycles

Utility Poles

Patrol Urban: 4 years
Rural: 6 years
Detail 12 years

Wires and Transformers

Patrol Urban: 4 years
Rural: 6 years
Detail Urban: 8 years
Rural: 12 years

Underground Facilities

Patrol Urban: 4 years
Rural: 8 years
Detail Urban: 8 years
Rural: 12 years

Service Reliability Requirements

The third rule establishes reliability monitoring and reporting requirements. While the previous two rules focus on maintaining systems, this rule is intended to help identify circuits that are prone to failure so they can be improved.

Companies must identify and analyze their worst-performing circuits and disclose those in an annual report to the commission.

Special attention is given to those circuits among the 5 percent performing most poorly. If a circuit is on this list for two of three reporting years, the company must provide a detailed correction plan.

Measuring Quality of Service:

- Installing a good computerized tracking system is key to measuring reliability.
- In the past some utilities had “artificially” good numbers because they did not have good tracking systems.
- The measurement indices are all the same, but most states don’t even look at them until there are widespread reports of a problem.

Uniform Reliability Standards

- The reliability rule uses standardized Electric Power Distribution Reliability Indices established by the Institute of Electrical and Electronics Engineers, Inc.
- These standardized methods allow for a fair comparison of the performances of all circuits to best identify those failing to perform at an acceptable level.

IEEE Reliability Metrics

- System Average Interruption Frequency Index (SAIFI)
  - The average frequency of service interruptions per customer
    - Total number of customer interruptions / Total number of customers served
- Customer Average Interruption Frequency Index (CAIFI)
  - The average number of interruptions per customer
    - Total number of customer interruptions/total number of customers affected
- System Average Interruption Duration Index (SAIDI)
  - The average interruption in hours and minutes per customer served
    - Sum of all customer interruption durations / total number of customers served
- Customer Average Interruption Duration Index (CAIDI)
  - The Average interruption duration
    - Sum of all customer interruption durations/total number of customers served

Rules Work Together

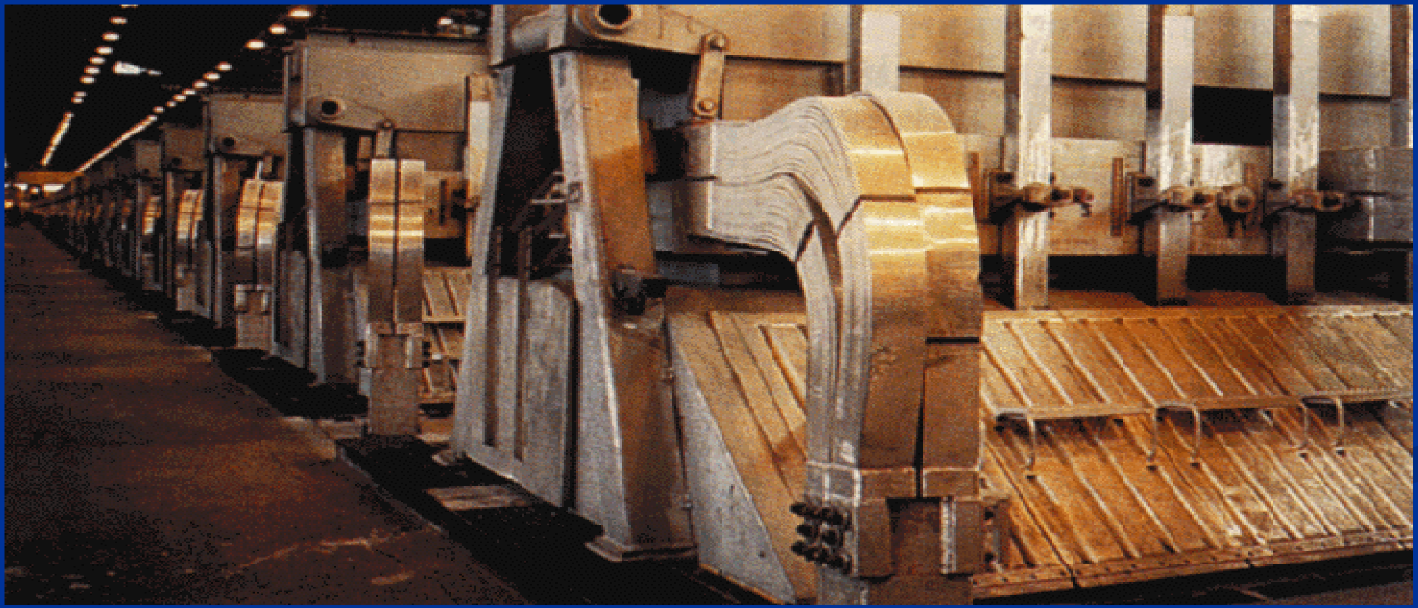
- These rules were developed to work together to help improve reliability and reduce the frequency and duration of outages.
  - Regular vegetation management reduces outages due to storm damage.
  - Regular inspections help detect weak poles or system components before they fail.
  - Standard reliability reporting helps identify circuits that are most trouble prone.

Challenges in Developing Rules

- Cost
  - Consumers ultimately pay for additional costs associated with improvements. Each factor must be weighed against the benefit it brings in improved reliability.
  - Missouri was able to secure 90 percent of the benefit at 10 percent of the potential cost by avoiding costly devices or requirements that brought minimum benefits.

Challenges in Developing Rules

- Benefits
  - Direct cost to ratepayers for repairs
  - Extended costs of lost jobs and productivity, costs to companies such as Noranda reach even to other nations.



Geographic Challenges

- Specific weather and geographic challenges play a huge role in developing effective plans
  - Ice storms have caused five of the last six major outages in Missouri.
  - Hurricanes, such as Katrina, that stuck the Gulf Coast, required to use of utility workers from Missouri to rebuild.
  - Vegetation, such as Kudzu, requires especially aggressive methods.

Seismic Risks

- Major earthquakes in California in 1989 and 1994 resulted in extensive studies in how to best prepare utilities to withstand seismic risk.
- Key risk areas include:
  - Ground deformation;
  - Fragility of 230 kV and 550kV porcelain transformer bushings
  - Substation movement (connector breakage)
  - Amplified ground motions effect on transformer bases
  - Pole-mounted transformer failure
  - Pole breakage
  - Underground cable insulation degradation

California Energy Commission Electric System Seismic Safety and Reliability Report:

http://www.energy.ca.gov/reports/2002-01-10_600-00-031/600-00-031_NOAPPENDICES.PDF

Hurricane-Force Wind Response

In 2002, the IEEE updated the National Electrical Safety Code setting standards for the extreme wind loading requirements for aerial electric distribution and transmission facilities in the United States.

Rule 261 A1c and Rule 261 A2f requires wind-load factors that apply only to structures up to 60ft in height. Rule 250c requires extreme wind load requirements to apply to both structures and lines taller than 60ft.

Minimum standards are set according to the geographic zone, with related wind speeds ranging from 90 mph to 170 mph.

In addition to inspection programs and undergrounding power lines, many states, like Florida, have adopted these new standards to help reduce outages due to extreme winds.

Copies of IEEE standards are available at:
http://standards.ieee.org/nesc/

Natural Disasters & Force Majeure

- There is no bright line test for determining when an electric utility is at fault or when nature is responsible for instances of force majeure. Decisions are made on a case by case basis.
- Factors include:

  -weather analysis (wind speed, amount of rain, etc.)

  -measure of utility's performance compared to peer group and historical data

Common Regulatory Problems:

- Restoring power in rural areas after major storms.
- A growing percentage of the population is unable to afford their utility bills. Large increases on customers bills anger public.
- Diversify our generation resources: Missouri gets almost 82% of its electricity from coal.

Best Practices for Electric Reliability:

- We have built redundancy (N-1 planning) into our generation and transmission systems. Thus, we always have electricity and transmission in reserve in case our largest line or plant fails.
- Infrastructure Surcharges allow gas and water utilities to install new distribution lines and get expedited cost recovery approximately 120 days of after filing to recover costs for completed projects.
- Critical facilities like hospitals receive incentives for maintaining back-up generation.

Best Practices for Storm Response:

- We analyze every major outage and recommend ways utilities can improve performance.
- Timely recovery of unanticipated costs related to storm outages improves recovery efforts and effectiveness.
- Utilities have cooperative assistance agreements with utilities in neighboring states that can provide thousands of additional workers for short-term reconstruction efforts.

Future Challenges

- Changes in Generation and Load Balancing
  - To reduce the use of coal, new wind generation sources are being developed.
  - This requires a dramatic change in load balancing when compared to conventional systems now used.
  - Each 100 mW of wind requires 50 mW of gas-fired generation to achieve load balance
  - Other alternative and renewable sources will require similar balances with gas-fired generation

Future Challenges

- Transmission
  - Increased use of alternative and renewable energy will require additional transmission systems.
  - These systems will require redistribution of existing resources for construction.
  - The acquisition of land and cost of construction will require a reallocation of resources.
  - Additional transmission will also increase system exposure to storm and disaster outage risk.

Future Challenges

- Increased Complexity
  - Cap-and-trade systems make capitalization more complex.
  - Smart-grid technology makes system management more complex
  - Costs associated with coal generation will affect the depreciation schedules of generating plants.
  - Environmental controls affect overall system planning and ultimate power costs

Questions?

Commissioner Jeff Davis

Missouri Public Service Commission
Jeff.Davis@psc.mo.gov
200 Madison St.
Suite 900
Jefferson City MO USA 65101
(573) 751-3233