AMERICAN ELECTRIC POWER

TEXAS RE

765 kV Transmission

Evan Wilcox – AEP
Kelly Bledsoe – AEP
Archie Pugh – AEP

July 16, 2026

Antitrust Admonition

Because this event brings together market participants who may be viewed as actual or potential competitors, we must be mindful to conduct it in a manner that is consistent with the antitrust and competition laws. Participants should not disclose non-public, proprietary, or competitively sensitive information.

Attendees should exercise independent judgment and avoid even the appearance of discussions of agreements or concerted actions that may be viewed as restraining competition. For example, avoid discussions regarding current or potential vendors or suppliers that involve sensitive information like pricing or terms, or discussions involving employee wages or hiring decisions. Any company decisions that are informed by your discussions today must be made independently.

This guidance is not intended as legal advice, and each attendee is responsible for seeking their own legal advice with respect to compliance with applicable antitrust and competition laws. However, any questions on Texas RE's Antitrust Compliance Corporate Policy may be directed to Texas RE's General Counsel.

Upcoming Events at Texas RE

July 21, 2026

CIP Roadmap

August 4, 2026

Defender’s Guide to AI and Machine Learning

October 8, 2026

Operational Technology

Upcoming Events at Texas RE

August 19, 2026

Winter Weatherization Workshop

September 16, 2026

Q3 MRC and Board Meetings

November 4, 2026

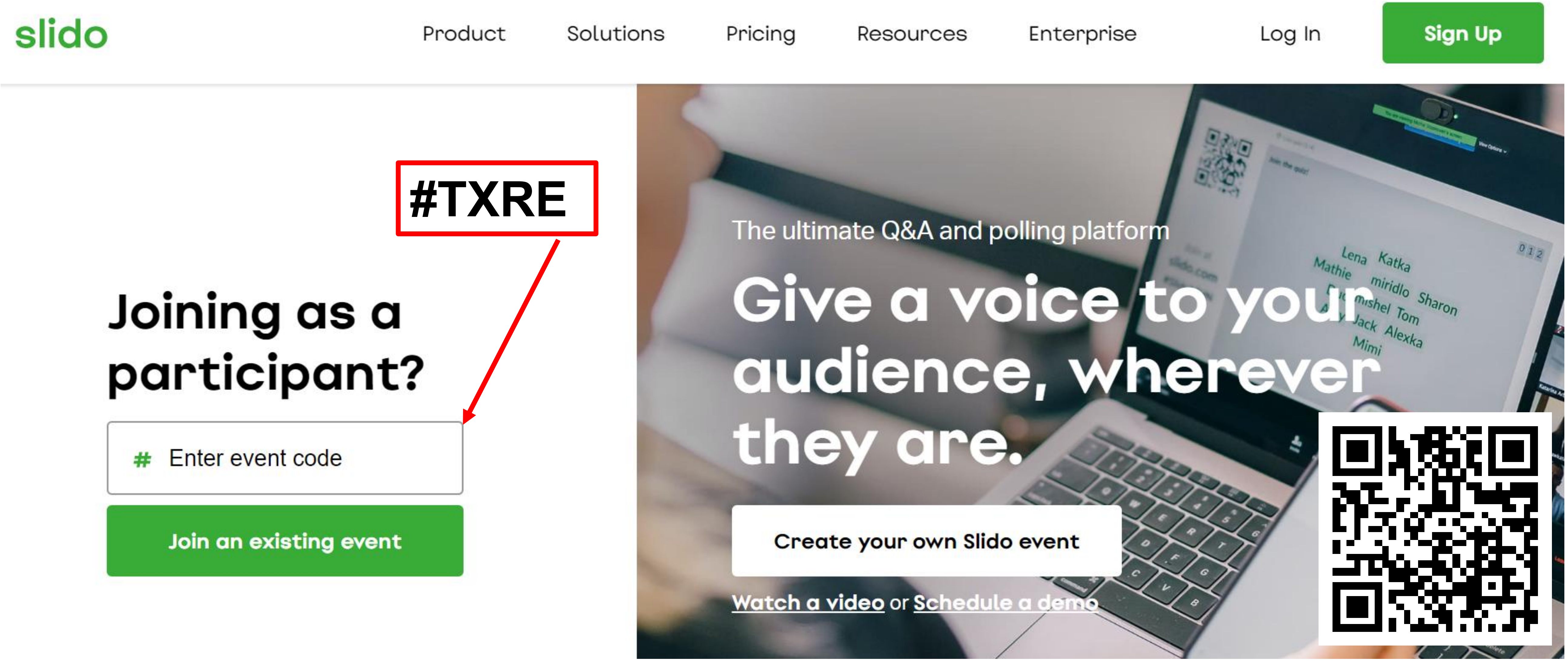
Fall Standards, Security, & Reliability Workshop

Upcoming ERO Enterprise Events

Date	Event
July 23, 2026	Future of Path Ratings in the Western Interconnection
July 29, 2026	SERC IBR Seminar #3
August 5, 2026	Protection Workshop
August 6, 2026	Planning Workshop

Slido.com

Public



HISTORY • DESIGN • MAINTENANCE • RESTORATION

AEP 765kV SYSTEM OVERVIEW

July 16, 2026

- EVAN WILCOX – Interconnection Services & Integration Planning
- KELLY BLEDSOE – Transmission Engineering Services
- ARCHIE PUGH – Project & Construction Management

AMERICAN ELECTRIC POWER

History of AEP's 765kV System

1953
AEP begins operating world's first 345kV transmission line between Ohio and West Virginia

1961
Research begins on higher-voltage transmission at Apple Grove, West Virginia

1966
AEP announces plans to build world's first 765 kV transmission system

1967
Construction begins on first 765 kV line, connecting Big Sandy Plant in Kentucky and Marquis Substation in Ohio

1969
First 765 kV line in operation

1971
First 765 kV interconnection between utilities: AEP and Commonwealth Edison

1975
World's highest capacity transformer bank (3-million kilovolt-amperes) in operation at Marysville Substation in Ohio

1979
World's first 765 kV substation to use SF6 gas for insulation at Joshua Falls Substation in Virginia

1986
Final link in initial 765 kV overlay system complete and in operation, raising AEP's total network to over 2,000 miles

1987
AEP opens John E. Dolan Laboratory in Ohio to facilitate further in-house research and development

2001
First ever 765 kV SF6 gas dead-tank circuit breaker installed and the first ever 765 kV station to implement human machine interface technology, at Maliszewski Substation in Ohio

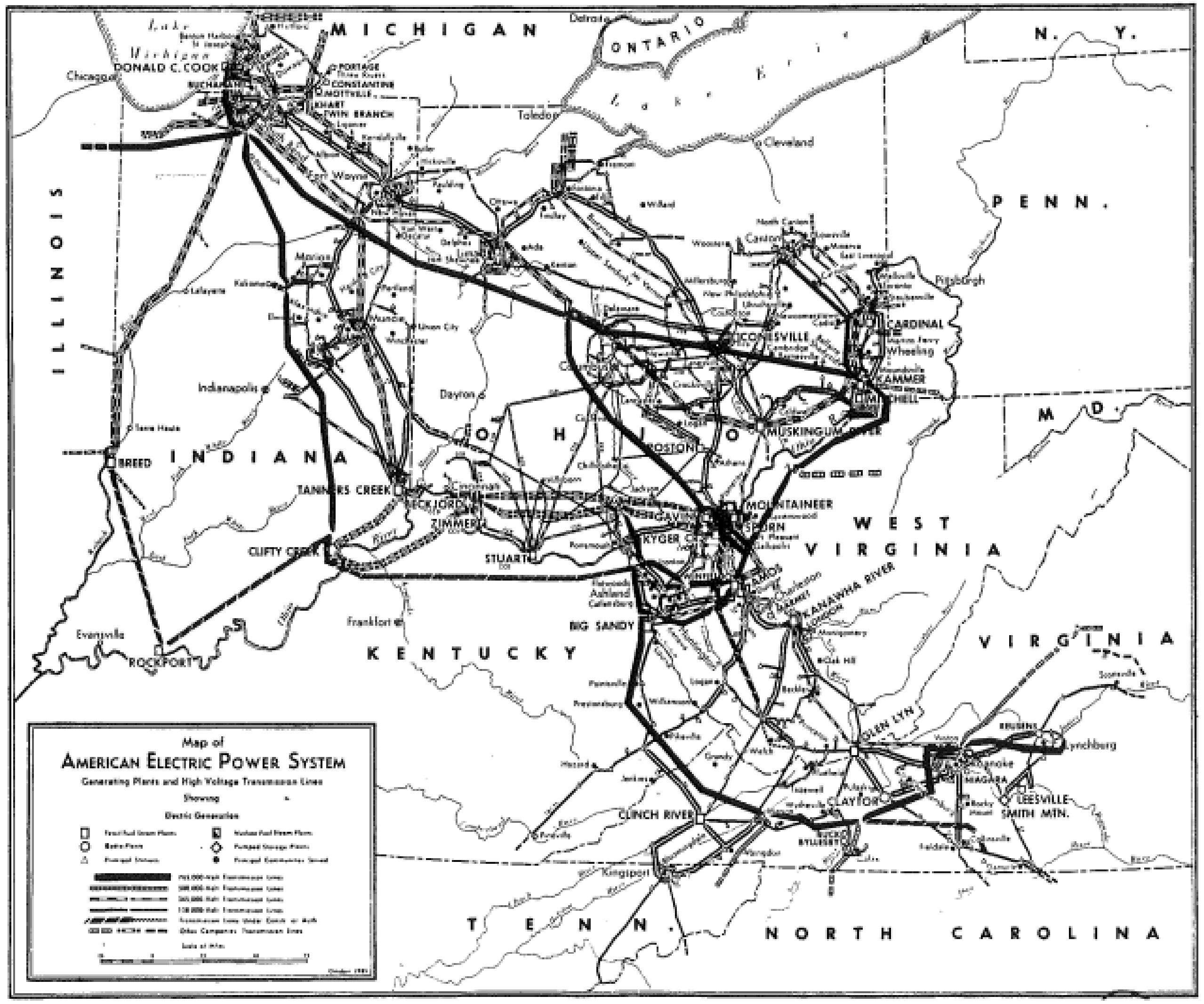
2003
AEP's 765 kV system withstands largest blackout in US history

2006
AEP develops and installs the first ever 6-bundle conductor in the US at Jacksons Ferry – Wyoming

2018
AEP's 765 kV transmission lines exceed 2,200 miles with the completion of Greentown-Reynolds in Indiana

2019
AEP modernizes 765 kV tower family structures for optimal line performance and conformance to the latest standards

2023
AEP wins SEEE Industry Excellence Award for its Emergency Restoration Structures program, allowing for rapid rapid repair of EHV transmission lines



765kV Testing

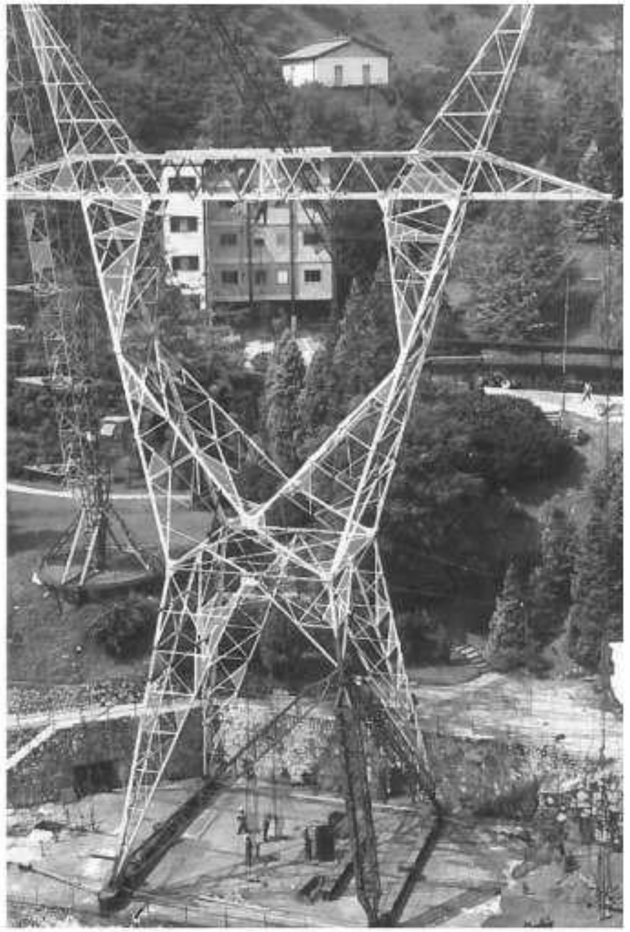


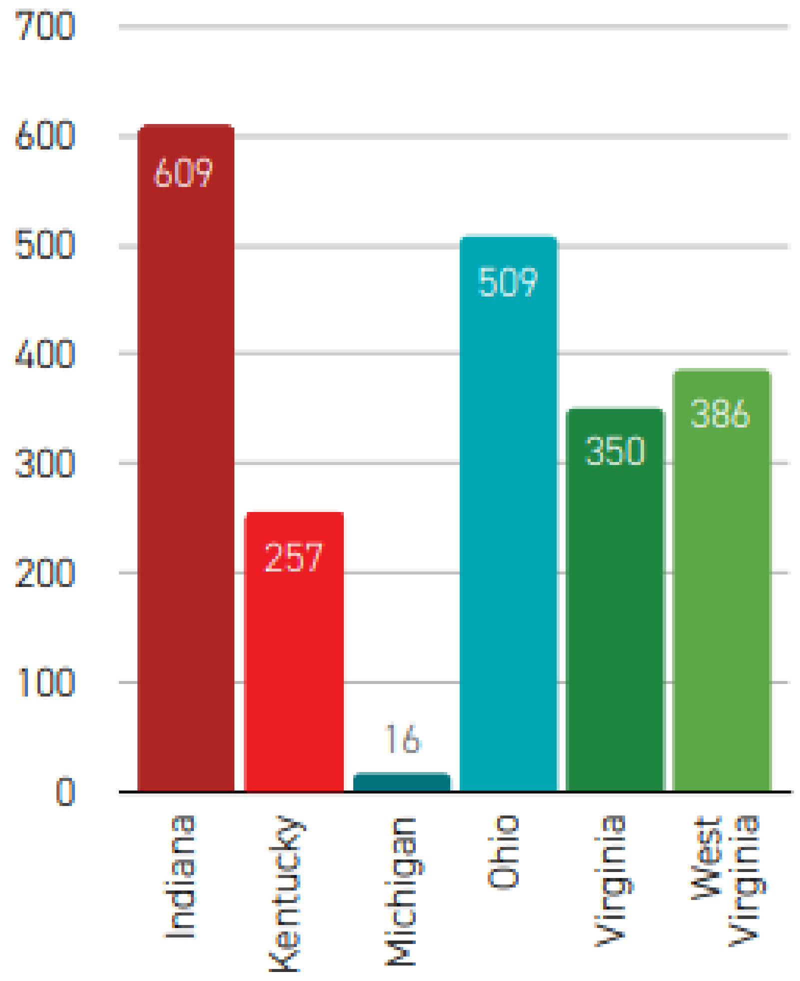
Photo of AEP 765kV Latticed Steel Dead-end Tower Full Scale Test Simulating Sidehill (front right leg)

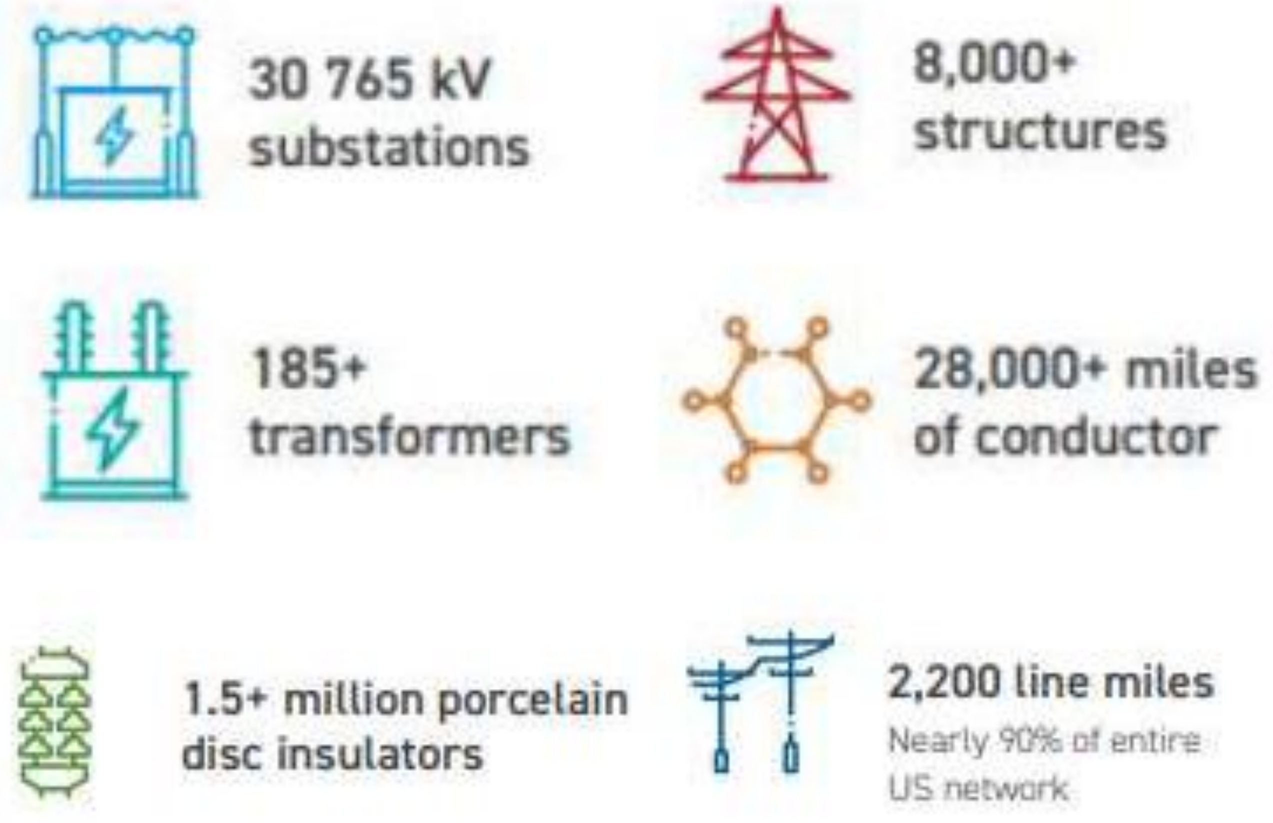
Photo: AEP's Apple Grove EHV Data Collection Tents

Insulator assembly design detail and photo of full-scale corona testing

1970’s 765kV Construction

Current AEP 765kV System (In-Service)

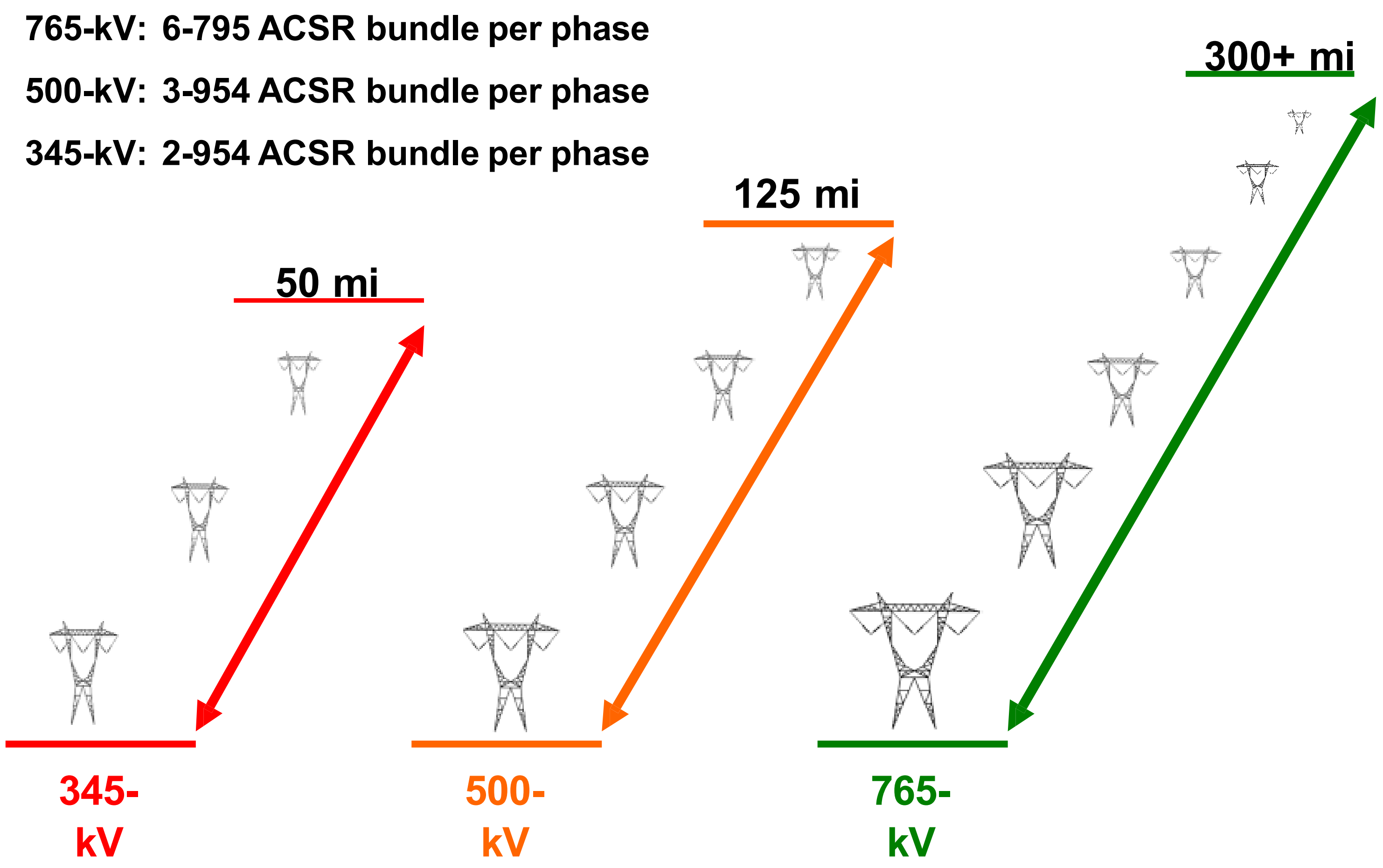




AMERICAN ELECTRIC POWER

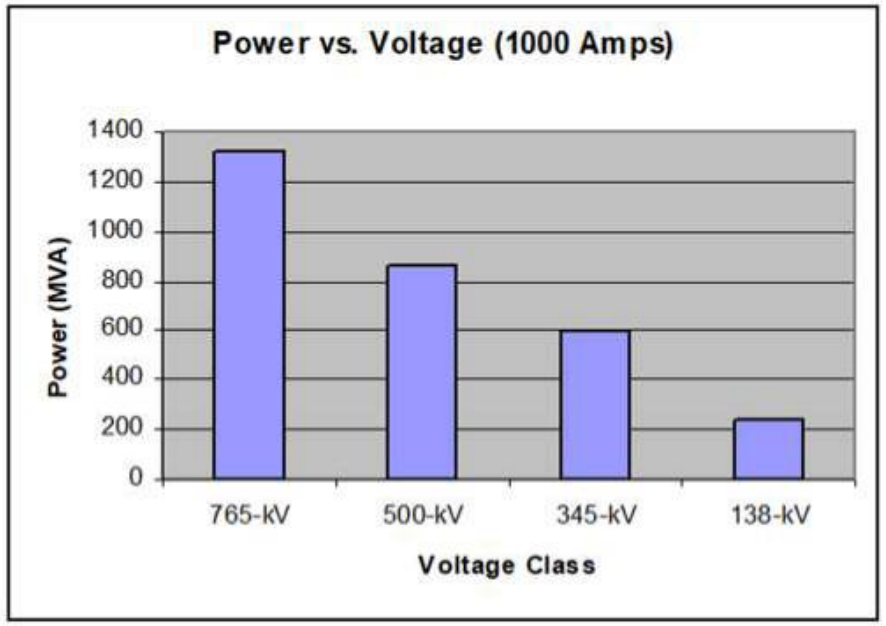
Electrical Characteristics of 765kV

- Lower impedance = shorter electrical distance.
- Brings geographically distant generation resources and loads electrically closer together.
- Enables longer distance power transfers.
- Maximizes efficiency (lower energy losses).

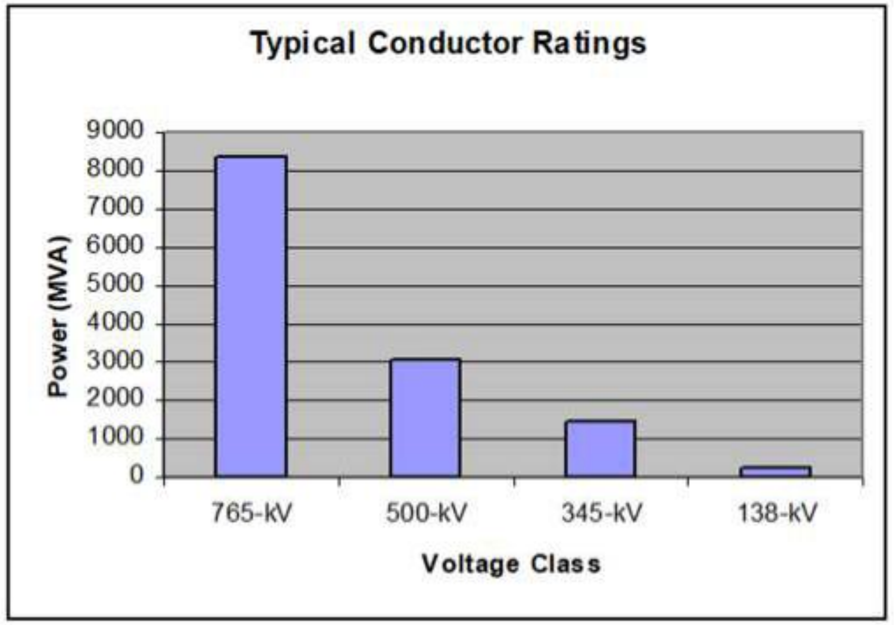


Equivalent distances based online impedance for different voltage classes.

765kV Power Carrying Capability

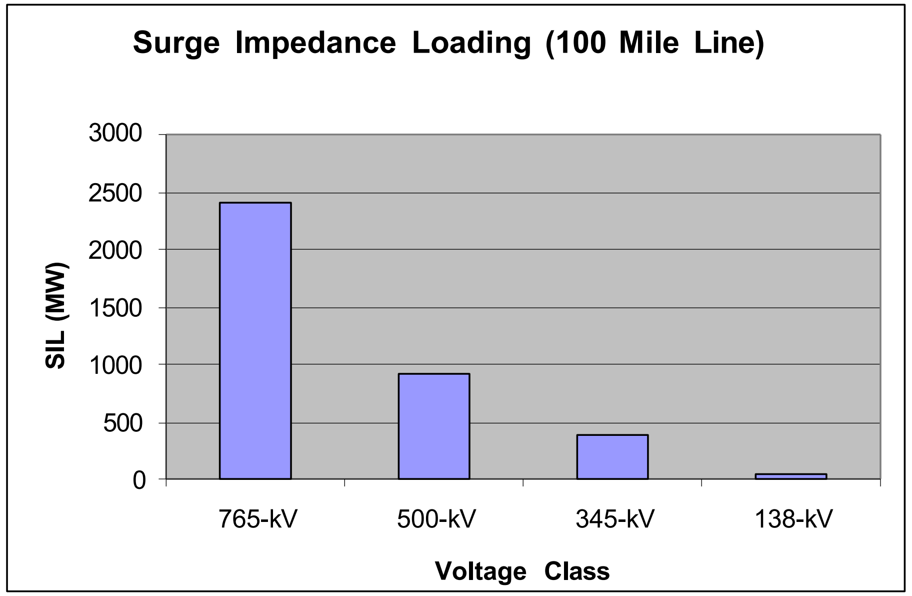


Power is directly proportional to the voltage - for an equivalent flow (Amps), the higher the voltage, the more power that is transmitted.



Line conductors (wires) and other equipment have a thermal limit to the current that can flow without heat damage.

Physical design of higher voltage lines (more robust equipment and conductors) further increase the amount of power that can be transferred.

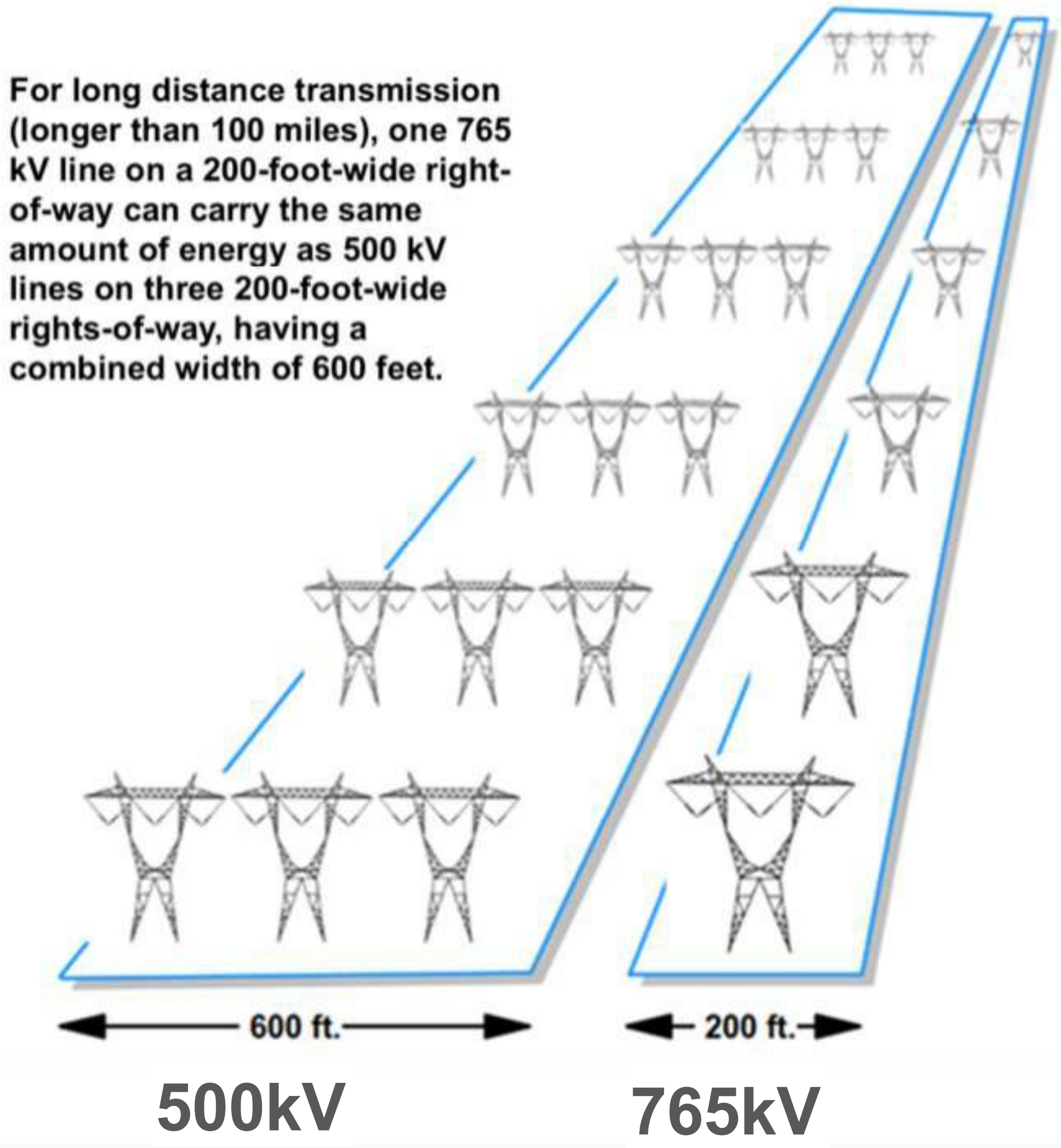


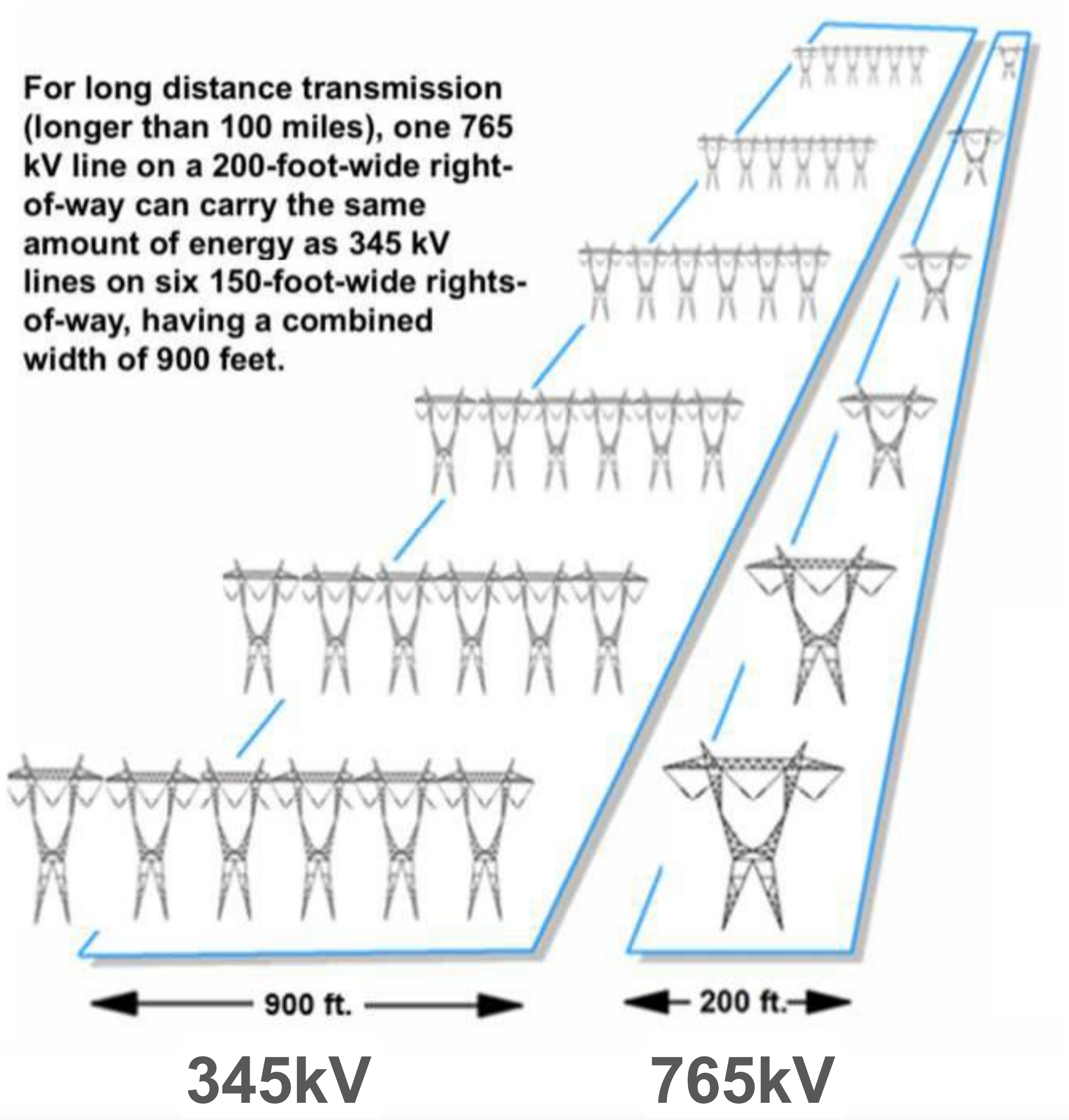
The quantity that compares transfer capability as a function of distance is referred to as Surge Impedance Loading (SIL).

The higher the voltage, the more power that can be transferred over a longer the distance (without voltage support).

High power transfer capability maximizes use of right-of-way corridors.

Transfer Capacity & Right-of-Way Use





Additional Considerations for 765kV

- **Planning for 765kV considers all of the same contingencies and NERC reliability requirements as any other transmission voltage.**
  - The system as a whole is designed to perform reliably even when elements of the 765kV experience an outage.

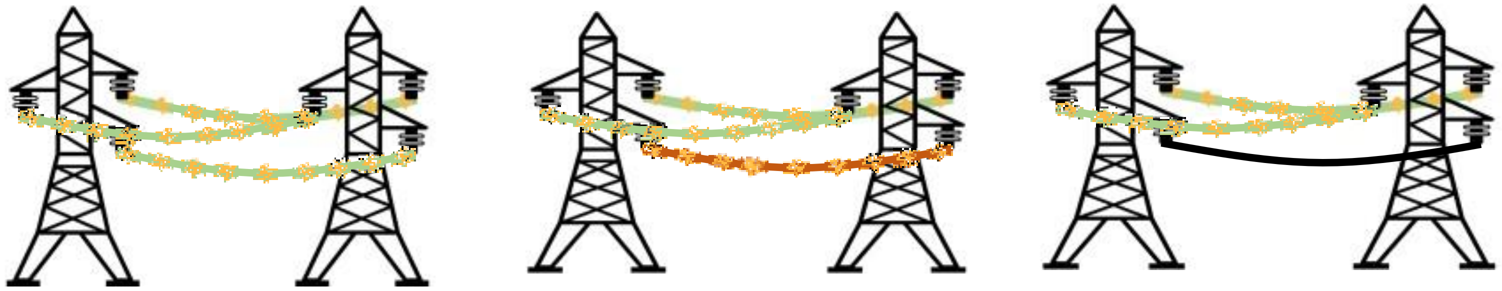
- **AEP 765kV system started as point-to-point (radial) connections, that were connected into a network system over time.**
  - A network provides maximum benefit but does not need to be built all at once.

- **Reactive power management is a necessary consideration.**
  - The benefit of 765kV's capacitive effects means high voltages can be experienced during periods of light loading.
  - AEP employs standard shunt reactors for voltage control and for line switching.
  - Transposition for very long lines recommended to maintain voltage balance across the three phases.

Additional Considerations for 765kV

- **Wide physical distance between individual phases at 765kV reduces the probability that an event will cause an outage of all three phases simultaneously.**
  - Outside of a major event causing a tower collapse (e.g., a tornado), AEP has never experienced a permanent three-phase fault at 765kV.
  - Outage rates for 765kV around 0.5 per 100 miles per year, roughly half of other EHV voltages.

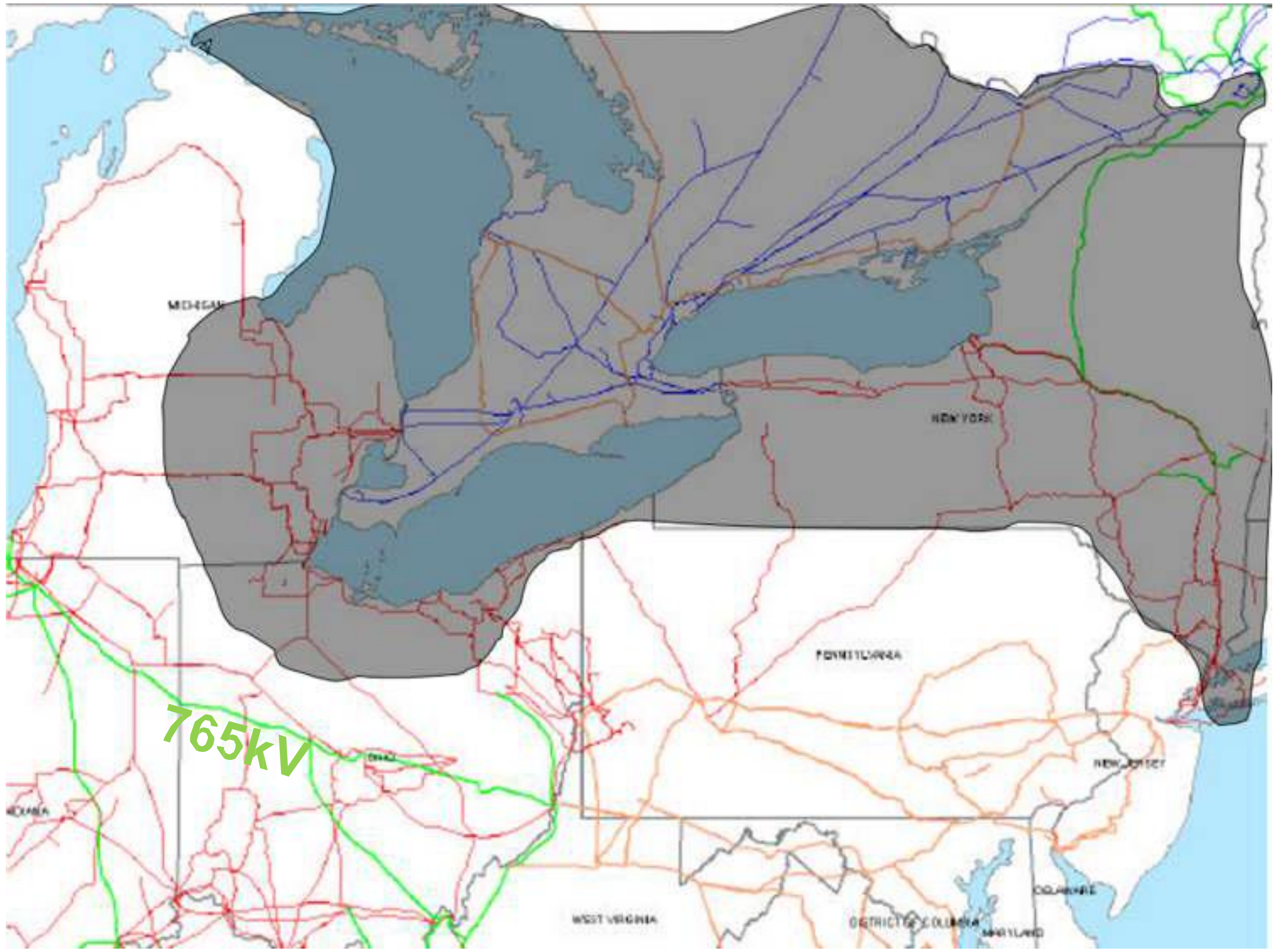
- **765kV station equipment (circuit breakers, shunt reactors, etc.) are built as single-phase units.**
  - Allows for single-phase spare equipment, and on-site switchable spare transformers to reduce downtime.
  - Facilitates single-phase switching in real-time operations to reduce impact of momentary faults.



System Normal Fault Single Phase Switching

Case Study: 2003 Northeast Blackout

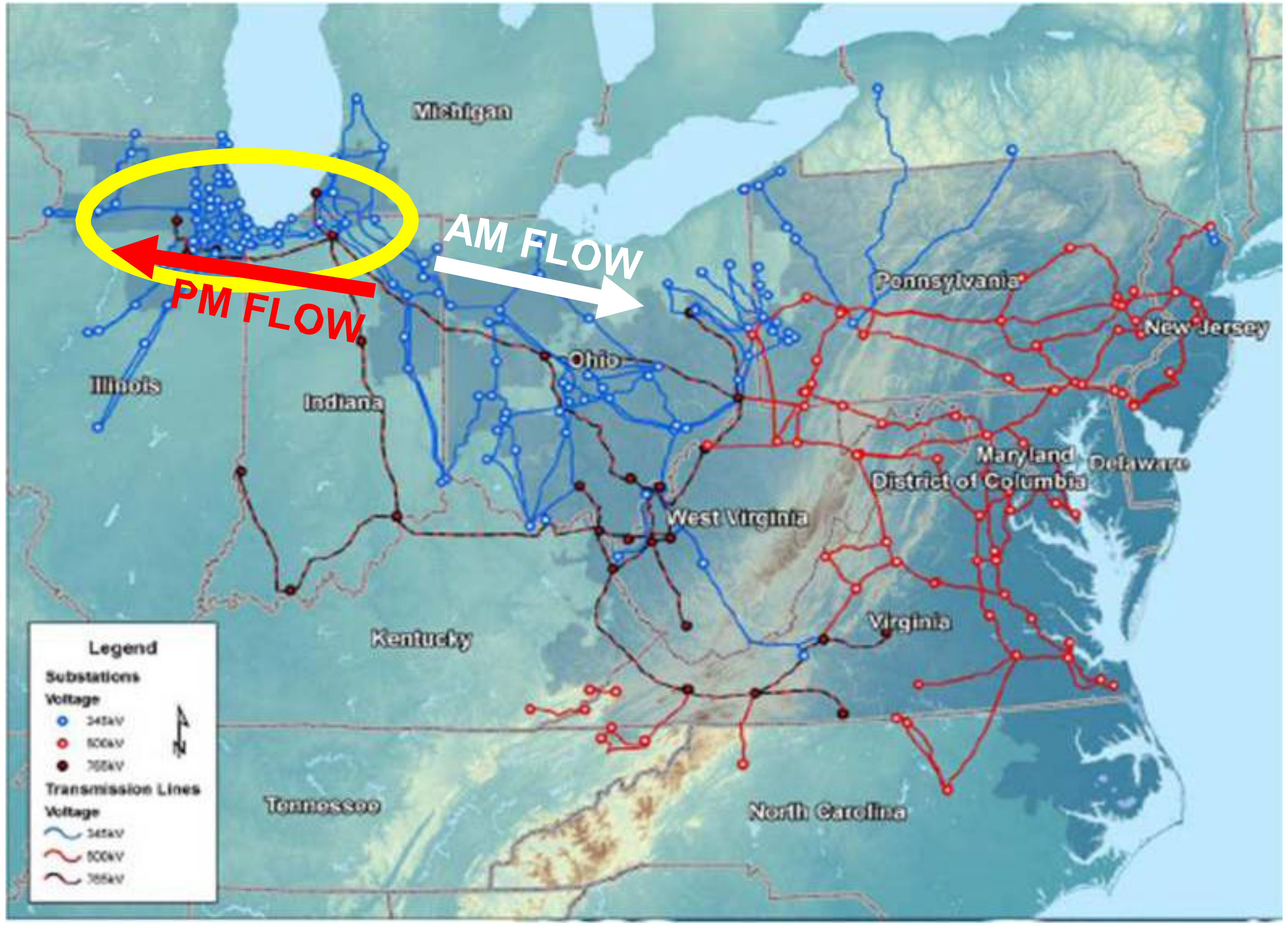
- Outage to ~50 million people on August 14, 2003.
- Initiating event in Ohio, cascading across the Northeast U.S. and Canada.
- Led to mandatory and enforceable NERC reliability standards.
- 765kV and 500kV network in PJM credited with limiting the cascade, due to their ability to “absorb voltage and current swings”*.



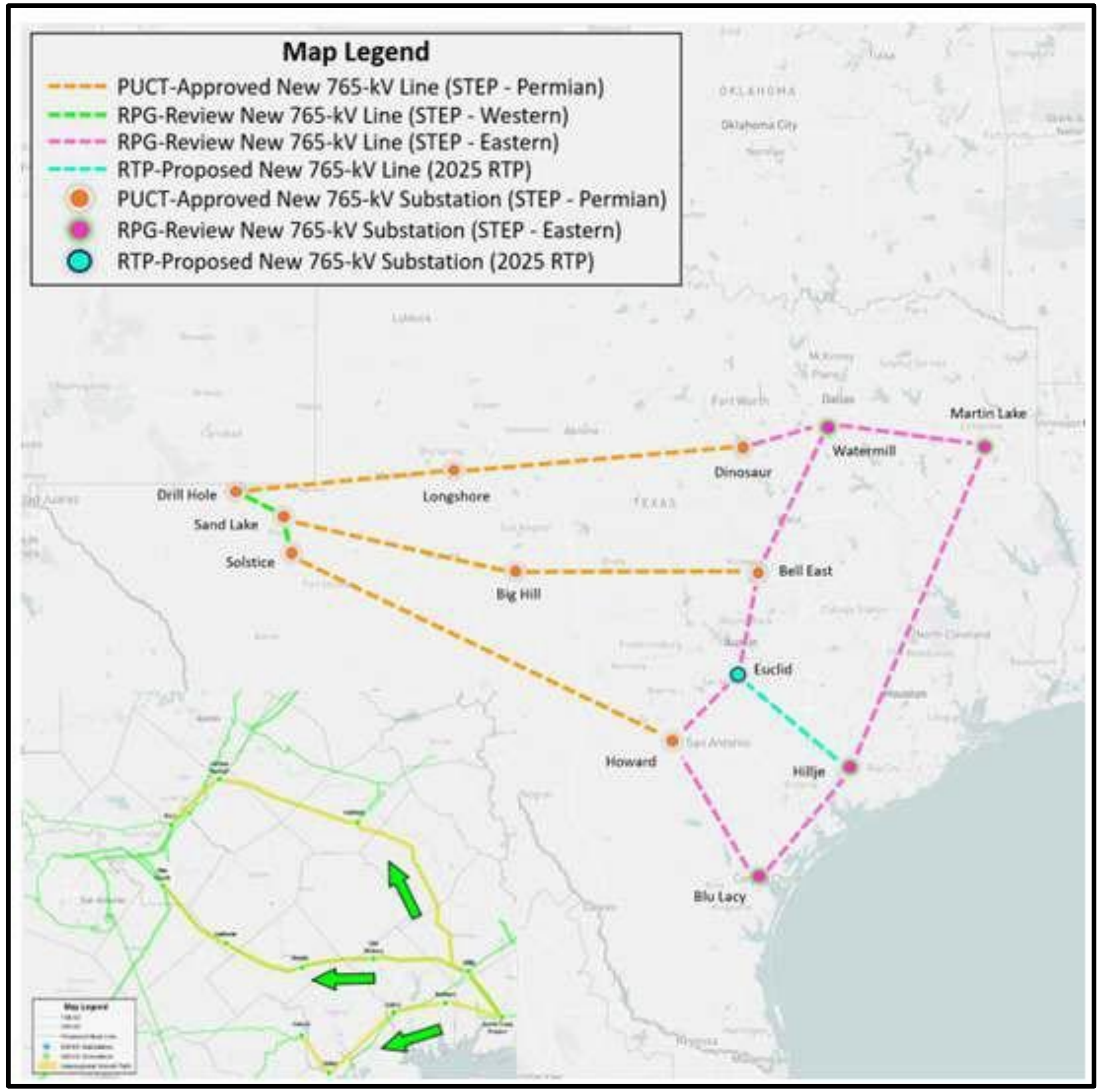
* U.S.-Canada Power System Outage Task Force, *Final Report on the August 14, 2003 Blackout in the United States and Canada – Causes and Recommendations,* (April 2004)

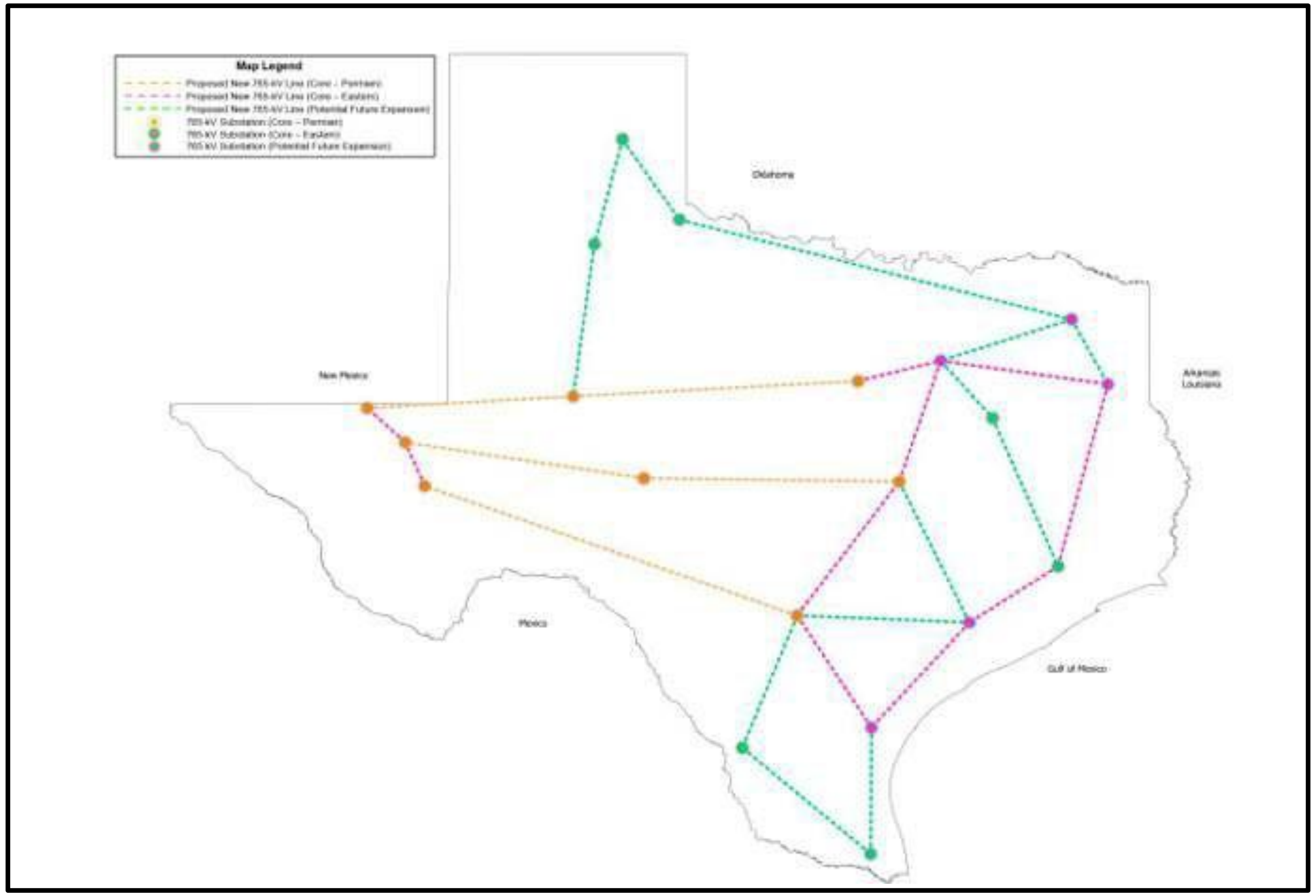
Case Study: Upper Midwest Heat Wave (2008)

- During the AM hours, morning load on the east coast caused loading on the Dumont-Wilton Center 765kV line to exceed 3,000 MW from West to East.
- That same day, an unusually hot weather system moved into Minnesota and Wisconsin.
- By the afternoon, power transfers swung the complete opposite direction, with 3,000 MW loading on the same line from East to West.



ERCOT Planned 765kV





* *2025 RPG meeting – 2025 RTP – 765kV Update* (November 11, 2025)

765kV Line Engineering & Construction

765kV Structure Types

GUYED-V LATTICE

- Suspension and Running Corners
- Light and Versatile
- Reduced foundation spoils
- Helicopter Construction

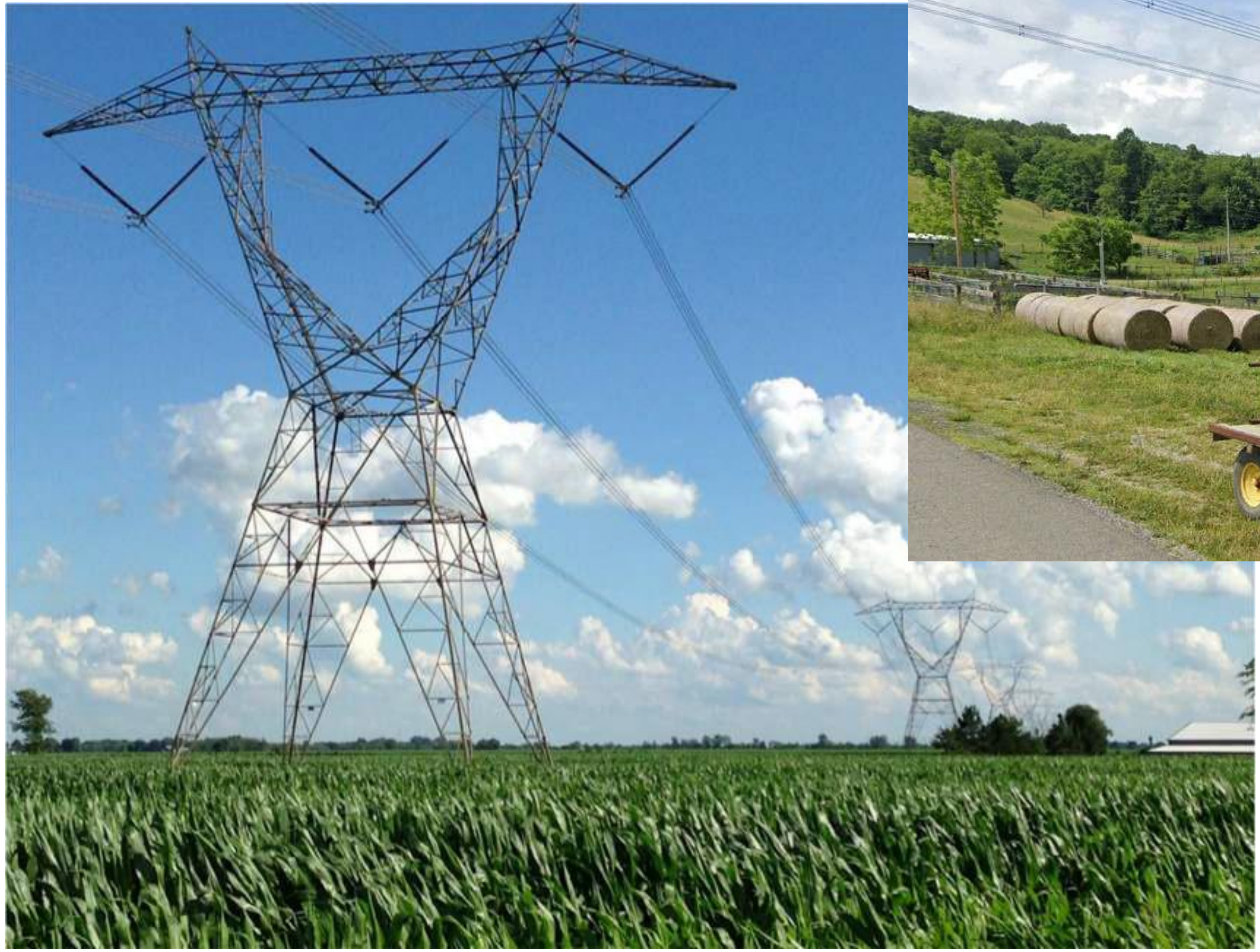
SELF-SUPPORTING LATTICE

- Suspension, Running Corners, and Dead ends
- Smaller Footprint

EMERGENCY H-FRAMES

- Kitted for Storage and fast deployment
- Readily Available throughout service territory

Land Use



AMERICAN ELECTRIC POWER

Habitat

765kV Conductor Bundle Design

Electrical Advantages

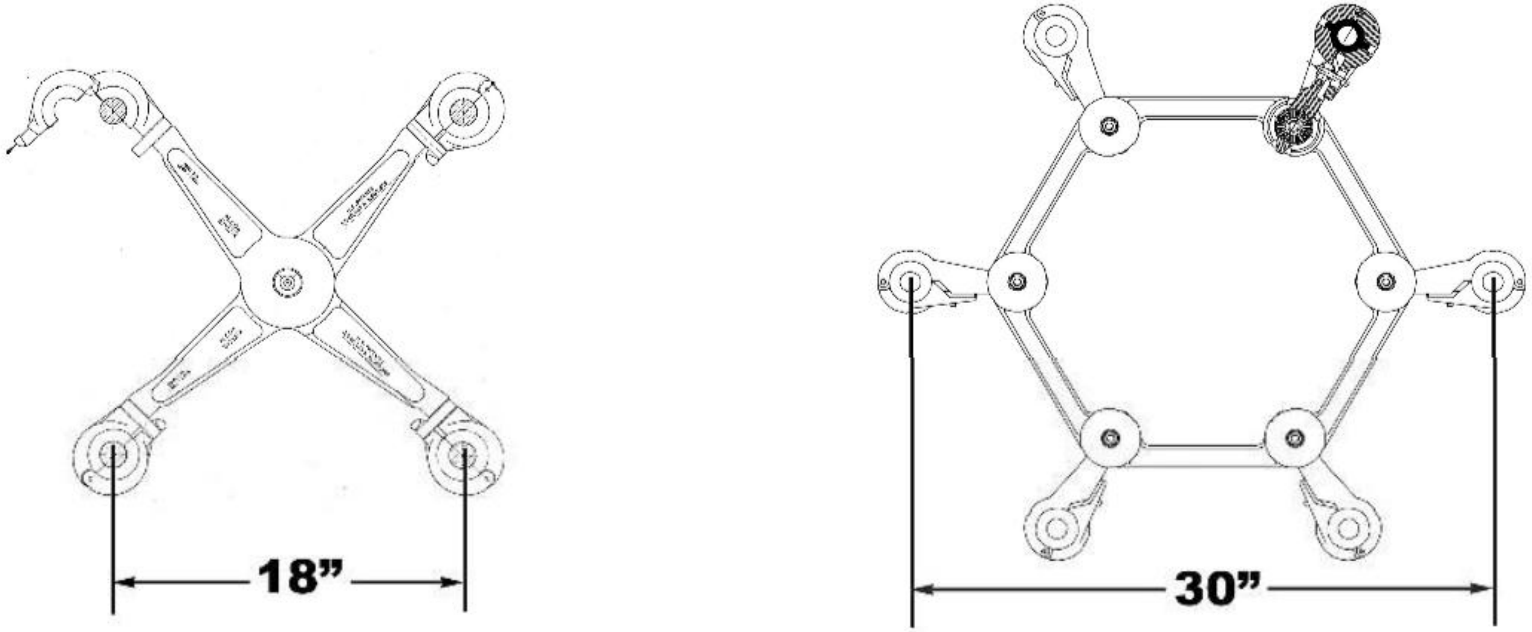
- Reduction in radio interference levels
- Reduction in audible noise levels
- Reduction in corona losses

6-Bundle Spacer Damper

- Placed approximately every 200 feet
- Extensive electrical and mechanical testing

4 Bundle Arrangement

6 Bundle Arrangement



1960-1970
4 - 954kcm ACSR 45/7
Diameter = 1.165”

1970-1980
4 - 1,351kcm ACSR 45/7
Diameter = 1.386”
Surface Area +19%

2006
6 - 795kcm ACSR 45/7
Diameter = 1.063”
Surface Area +15%

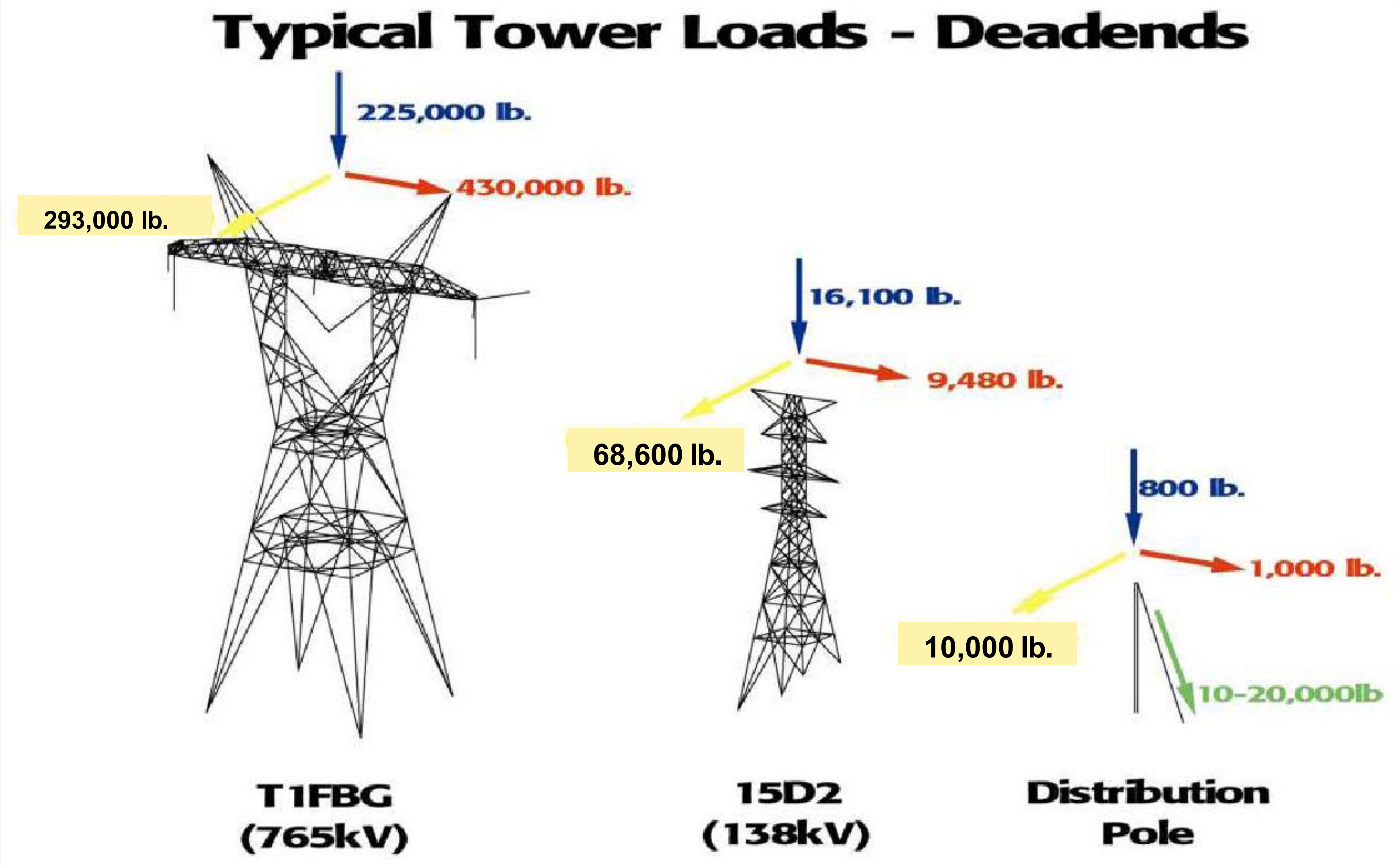
765kV Structure Loading

Bigger because:

- Larger Loads due to 6 conductor bundle
- Increased ground clearance required for voltage

Results in:

- Larger structural loads
- Increased height to maintain code clearance
- Increased right-of-way requirements (765kV – 200 ft.; 138kV – 120 ft.)
- Larger Tower Footprint
- Heavier hardware and Assemblies
- Increased span lengths

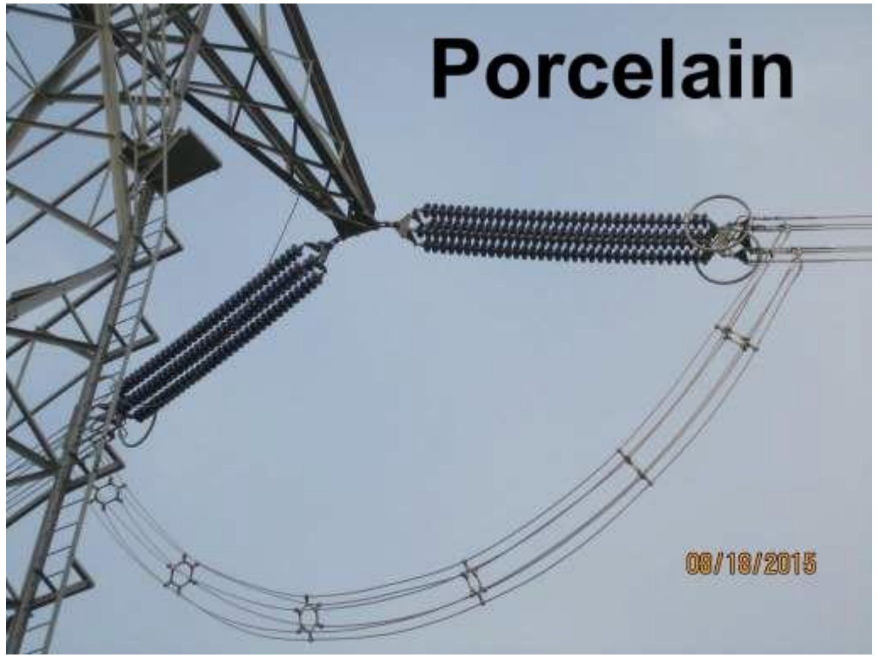


765kV Insulation & Hardware

Design Goal:
Long term, maintenance free, reliable service for the life of the transmission line (50 yrs).

Insulation accounts for only **5%** of the capital cost of transmission lines, however, it accounts for:

- **70%** of line interruptions and
- **50%** of maintenance costs



AMERICAN ELECTRIC POWER

765kV Insulation & Hardware

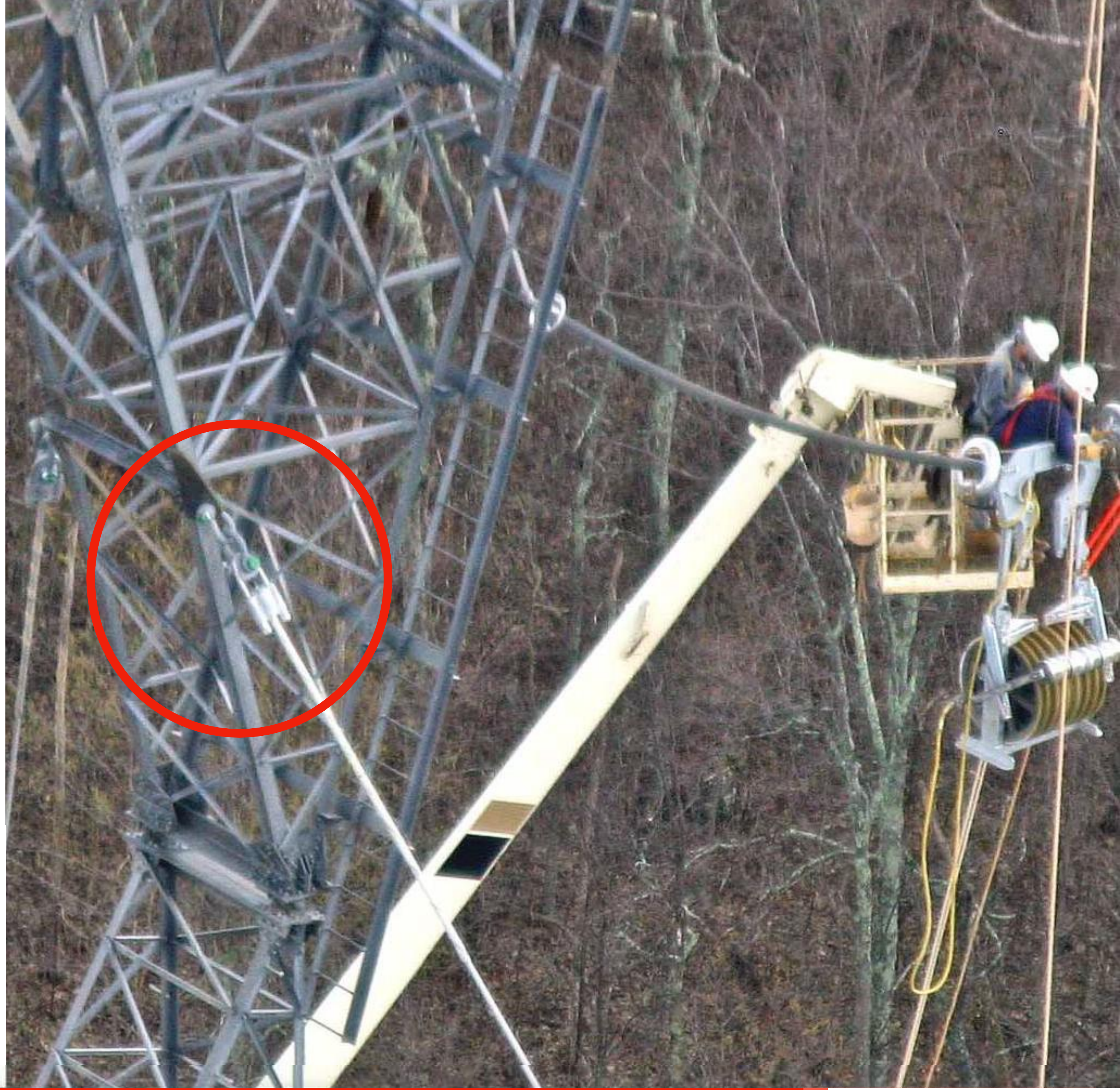
6-Bundle Suspension Plate

Polymer Suspension V-String Configuration

765kV Dead-End Sediver Insulator String

Ceramic Suspension V-String Configuration

AMERICAN ELECTRIC POWER®



Guyed-V tower: Anchor shackle used for guywire attachment – 135 lb.

Example – 765kV Large Scale Components

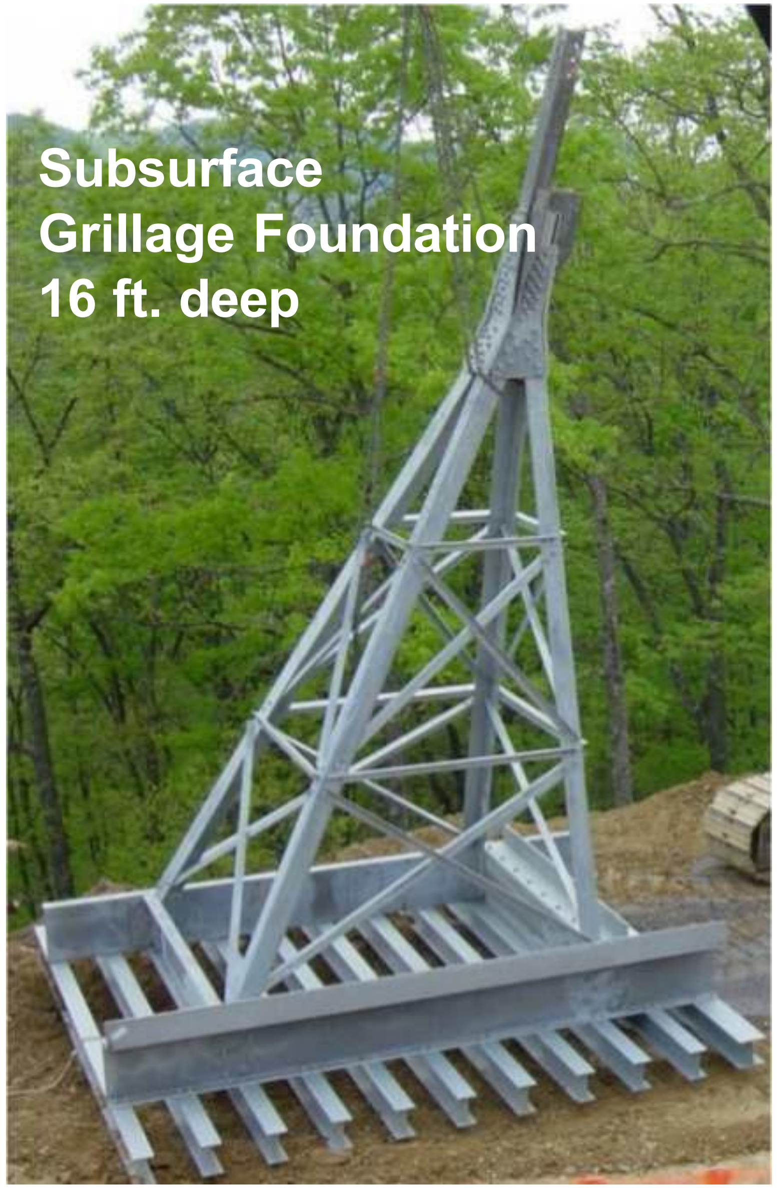
765kV Foundation Types

DESIGN DRIVERS

- Constructability
- Subsurface conditions
- Site Access
- Concrete Availability
- Presence of Rock

PROVEN FOUNDATION OPTIONS

- Grillages
- Concrete Drilled Shafts
- Micropyles
- Adaptability – Base shoe for various connections to any foundation.



765kV Emergency Restoration

Rockport - Jefferson 765 kV
Structure 246
March 2, 2012, tornado

AMERICAN ELECTRIC POWER®

765kV Emergency Restoration Structures (ERS)

ERS Stocked Kit

- In total, ability to restore 4-5 miles of 765kV lines
- Strategically staged across system, ready for deployment
- Reduces restoration times from 16+ weeks to ~4 weeks

765kV Station Design

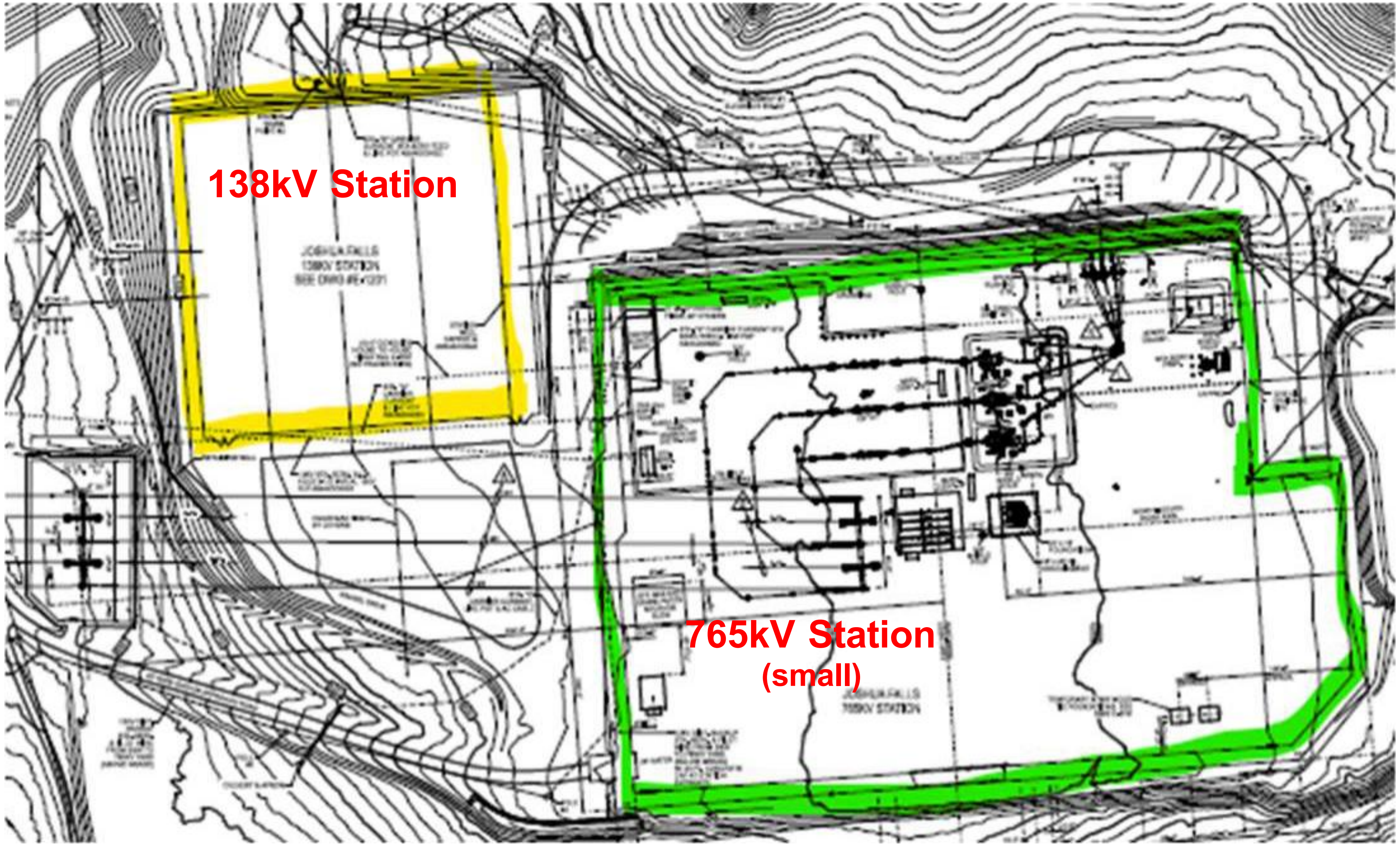
765kV Station – Physical Space

DESIGN: 765kV yards are typically arranged in a CB & ½ layout or double bus-double breaker layout for reliability purposes.

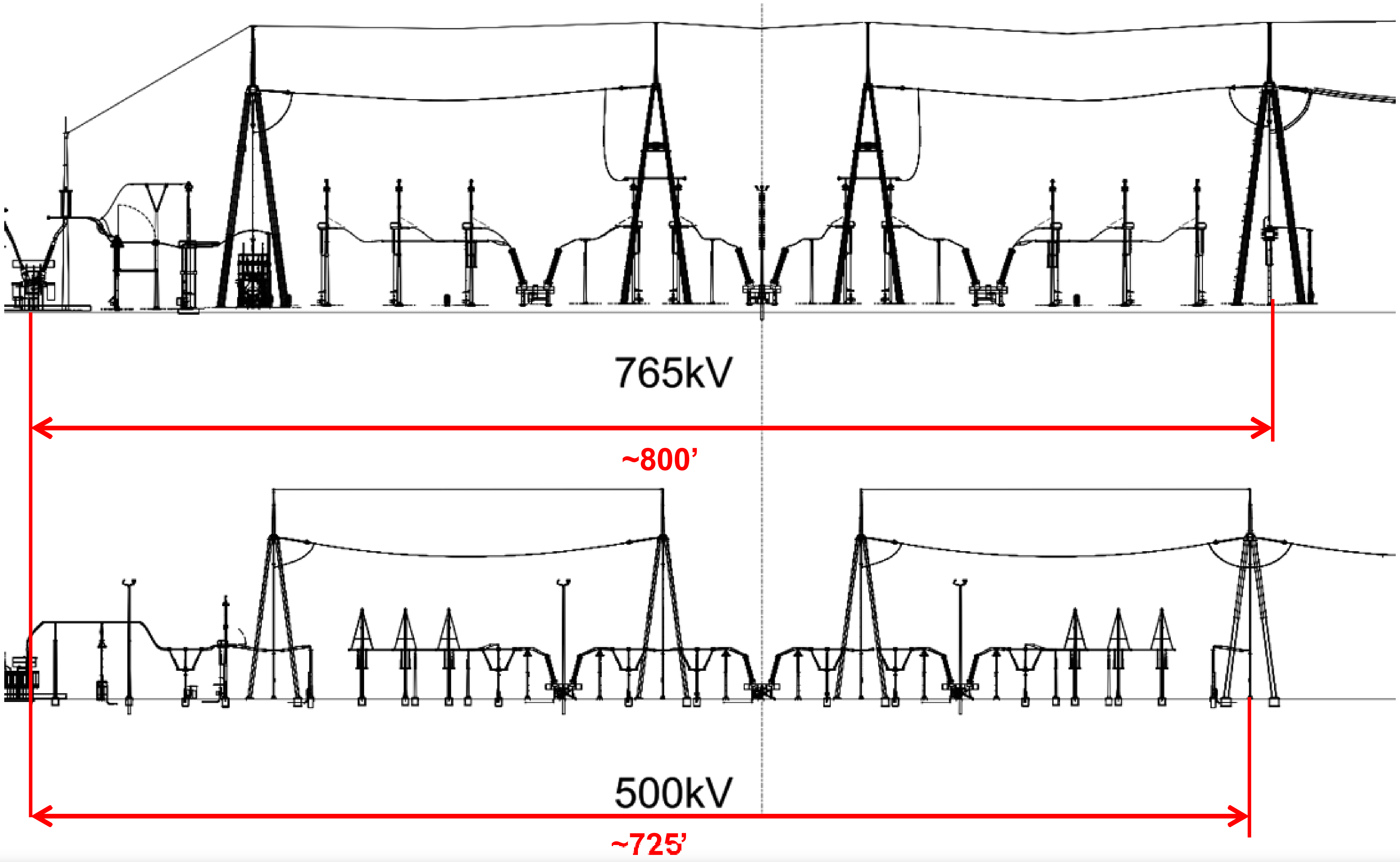
- Average size of **<u>LARGE</u>** 765kV yard: **1497' x 1276' (43.9 acres)**
- Average size of **<u>SMALL</u>** 765kV yard: **891' x 600' (12.3 acres)**
- Average size of **<u>LARGE</u>** 138kV yard: **268' x 325' (2.0 acres)**

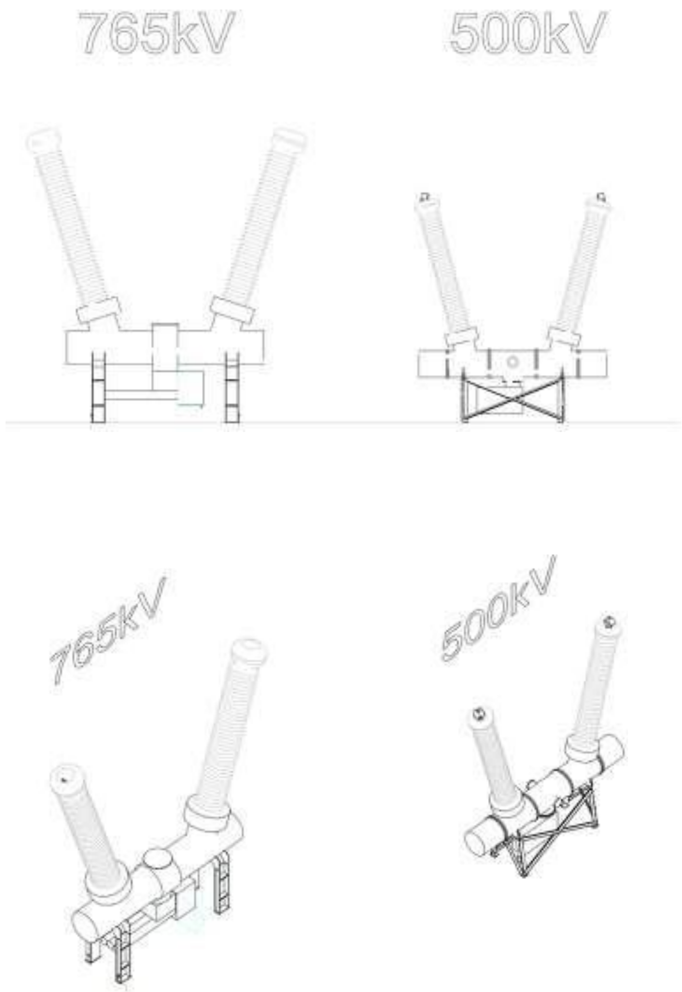
*Larger equipment sizes and clearance values are the main contributors to the increased substation sizes.

765kV Station – Physical Space



765kV/500KV Station Size Comparison





765kV Station Equipment Size Comparison

765kV

• Transformer	45’(H) x 37’(L) x 25’(W)	**590,000 lb.** (1 Phase unit)
• Circuit Breaker	33’(H) x 33’(L) x 5’(W)	128,950 lb. (1 Phase unit)

138kV

• Transformer	22’(H) x 30’(L) x 19’(W)	**223,986 lb.** (3 Phase unit)
• Circuit Breaker	13’(H) x 8’(L) x 6’(W)	6,614 lb. (3 Phase unit)

** Typical Sizes*

765kV Transformer Design & Layout

SWITCHABLE SPARE ARRANGMENT

- Implemented as standard design ~2010
- Due to the criticality of 765kV power distribution and the lead time of 765kV transformer procurement, it is **NECESSARY** to design 765kV transformers with a spare unit in a pre-installed switchable arrangement with the single-phase units
- This is accomplished via our **switchable spare design configuration**

765kV vs 345kV – Transformer Size

765kV Transformer
- 3 single phase units
- 1 switchable spare
- 70 ft. between center lines of units

345kV Transformer
- 1 Unit, 3 phases
- 48 ft. total width

Thank you!

- EVAN WILCOX – Interconnection Services & Integration Planning
- KELLY BLEDSOE – Transmission Engineering Services
- ARCHIE PUGH – Project & Construction Management