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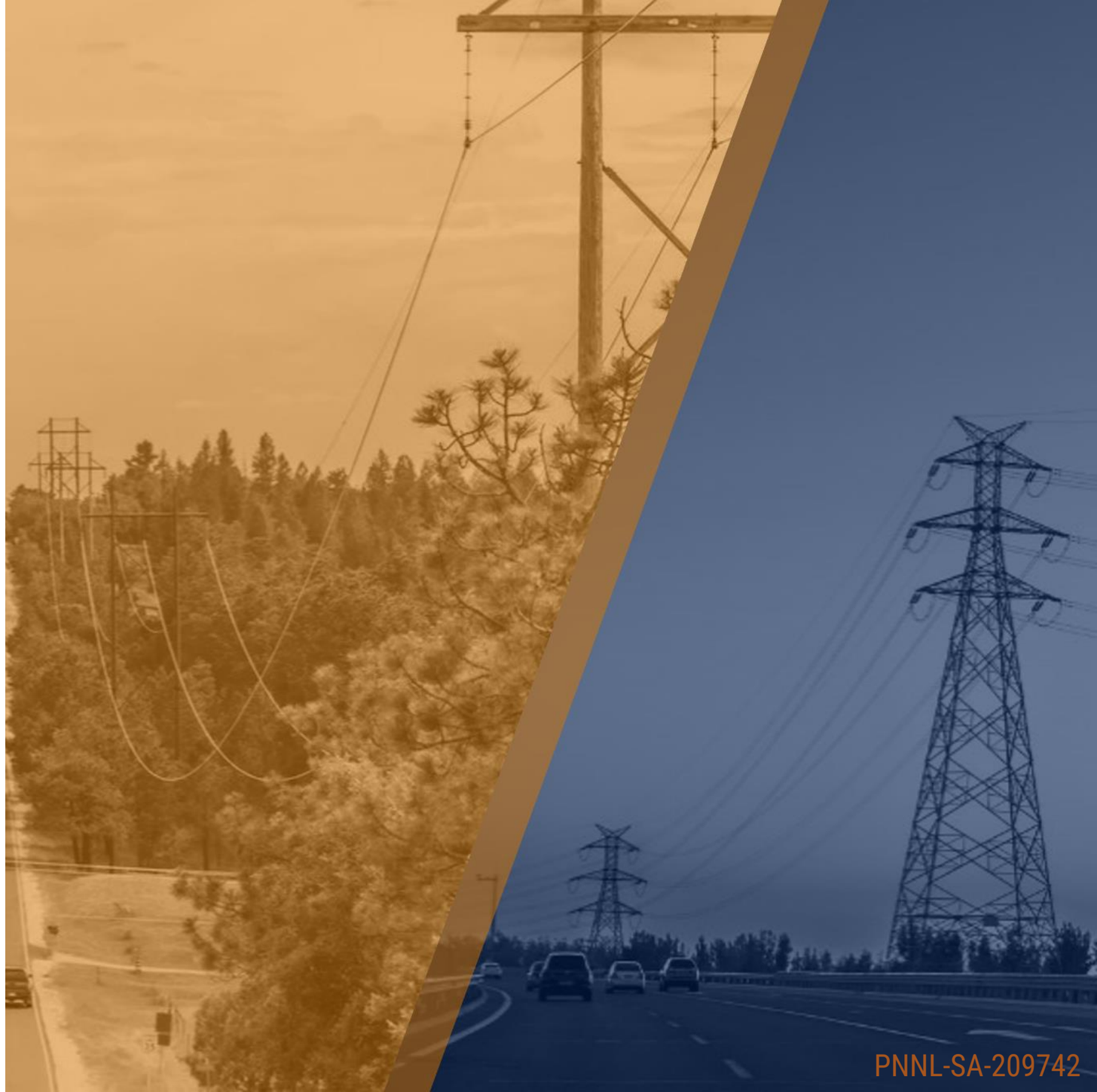
Electric Transmission in Transportation Rights-of-Way: Gaps Analysis

2025

Rebecca O'Neil, Jennifer Yoshimura, Vanessa Hamilton, Marcos Cruz, Paul Wetherbee, Lee Miller, Shannon Bates, and Kelly Gordon **(PNNL)**

Scott Gilman, Amy Plovnick, Gina Filosa, Maiya Baum, and Brennen Craig **(Volpe)**



PNNL-SA-209742

Electric Transmission in Transportation Rights-of-Way: Gaps Analysis

Purpose

Evaluate pathways to achieve federal goals for electric transmission development in transportation rights of way (ROWs).

Team

Combines transportation policy expertise at the USDOT Volpe Center and electric transmission investment planning and engineering expertise at PNNL.

Sponsor

Research investment sponsored by the Joint Office of Energy and Transportation.

Project Timeline and Overview

1

Research & Analysis

Reviewed utility and right-of-way (ROW) policies, ROW transmission projects, and siting requirements

2

Report Outline

Identified seven types of gaps to advancing ROW transmission

3

Stakeholder Interviews & Case Studies

Conducting interviews and investigating on-the-ground project experiences

4

Report

Finalized in Summer 2025

Gaps organized into 7 topical areas relevant to transmission and transportation

01 Policy
Analysis of policies governing transmission and transportation ROWs

02 Institutional
Organizations involved have separate missions and cultures

03 Planning
Potential relationships between transportation and transmission planning

04 Financial
Financial structures and motivations are different for transportation and transmission

05 Siting & Permitting
Authorizations and jurisdictions for project development in ROWs

06 Engineering
Complex design, construction, and operation, in compliance with codes and regulations

07 Rail
Each rail owner requires license agreements and has independent policies and procedures

01 Policy

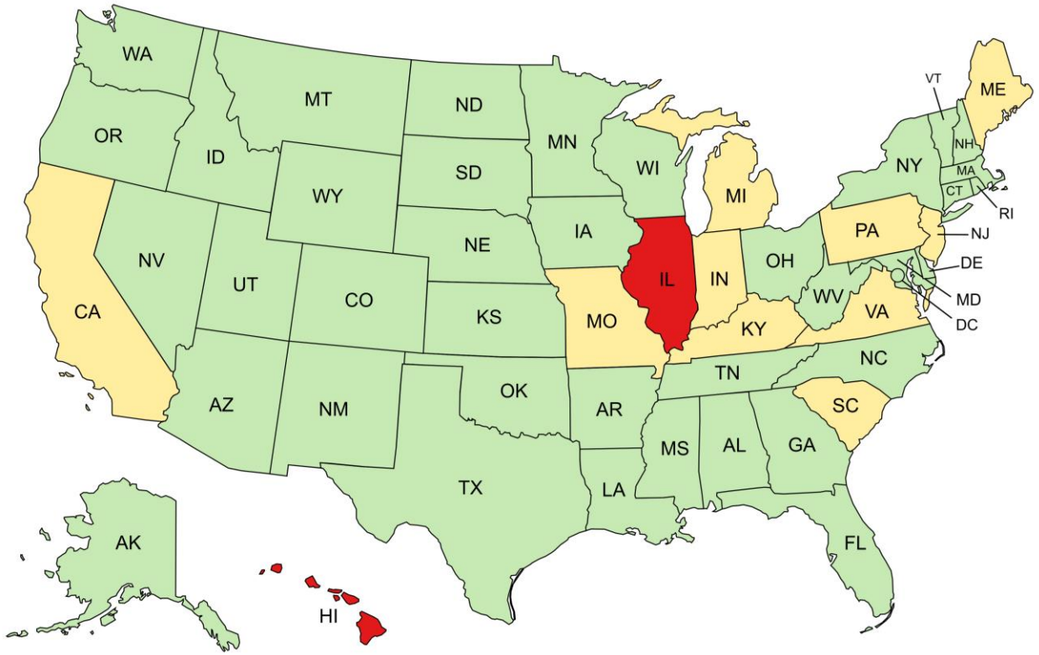
Analysis of policies governing transmission and transportation ROWs

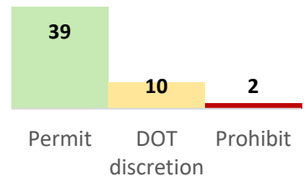
State DOT Utility Accommodation Policies

- Historically, public highway right-of-way has been reserved for highway purposes, with limited exceptions for utilities, by Federal laws and regulations
- Since 1988, state Departments of Transportation (DOTs) have had more latitude over what types of utilities are permitted in their rights-of-way
- State DOTs write Utility Accommodation Policies, which must be approved by the Federal Highway Administration (FHWA). **Utility Accommodation Policies determine whether and to what extent co-located transmission is permitted in each state.**

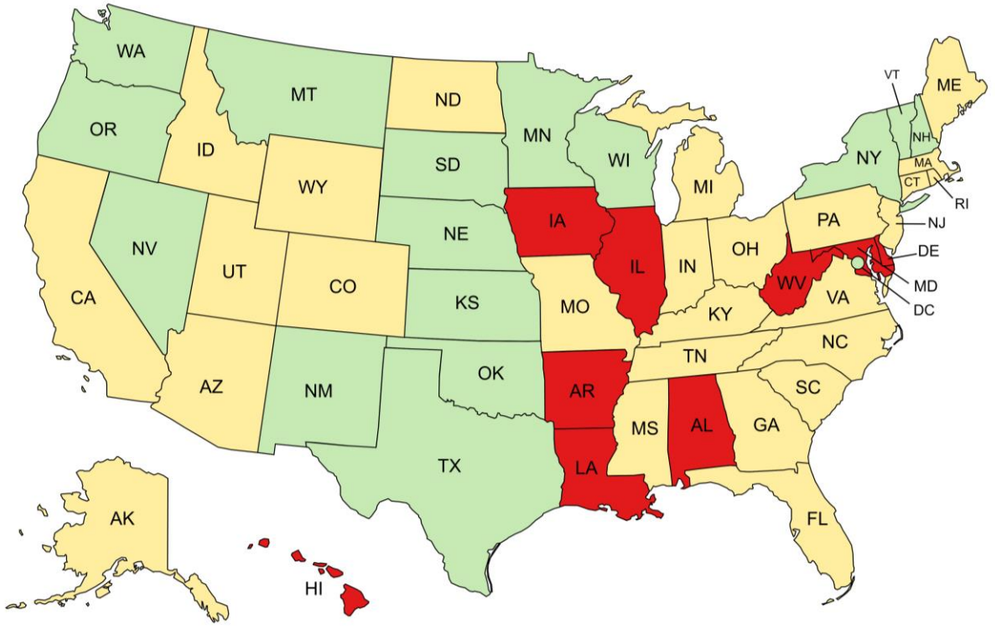
Many states restrict or prohibit the installation of transmission lines, especially in freeways

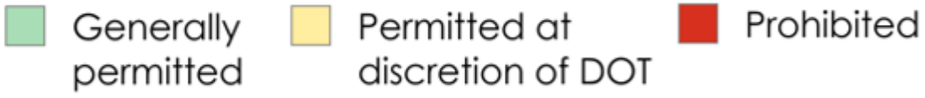
Prohibitions of Longitudinal Tx in Non-Freeways

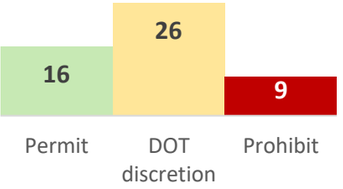




Prohibitions of Longitudinal Tx in Freeways







A growing number of states promote the use of Highway ROW for transmission

States with Statutory Promotion for Use of Highway ROW for Transmission		
 Delaware	Promotes use of transportation ROW for renewable energy projects over 30MW and connected to PJM transmission grid (2024)	84 Del. Laws, c. 401, § 13
 Florida	Transportation department shall accommodate 69KV or higher lines for baseload power (2021)	2021 FL Statutes Title XXVI Chapter 337 § 401
 Minnesota	Permits longitudinal transmission and requires consideration of ROW during the transmission permit application process (2024)	Sec. 161.45 MN Statutes
 Wisconsin	Comprehensive energy policy promoting use of transportation right of way (2003)	2003 Wisconsin Act 89
 Maine  New Hampshire	Energy policy promoting transmission siting on specific named interstates and routes (Maine 2010, New Hampshire 2016)	Sec. A-2. 35-A MRSA § 122(1-B) (ME) Chapter 162-R Energy Infrastructure Development and Corridors (NH)

States with Pending Legislation	
 Colorado	HB25-1292: Transmission Lines in State Highway Rights-of-Way | CCW
 Illinois	SB2146 (2025-2026)
 Maryland	SB483 (2025); HB645

03 Planning

Potential relationships between transmission and transportation planning

Transportation and transmission planning differ in important ways

TRANSPORTATION

01 Long-range Planning
- State DOT- or MPO-wide
- Vision/connection with broader goals; may include specific projects
- 20-25 years

02 Programming
- State DOT- or MPO-wide
- List of projects
- 4-5 years

03 Project Development
- Specific project/location
- Includes NEPA, engineering/design, ROW and utility coordination

04 Construction & Maintenance
- Specific project/location
- Includes utility coordination and relocation

TRANSMISSION

Planning 01
- Multi-state region (ISO/RTO)
- Paths/connecting zones
- Utility resource planning for load/ build forecasts
- 5-30 years

Siting 02
- Project proponent (utility, federal PMA, merchant)
- Specific route – may be multiple states
- NEPA, permitting

Engineering Design 03
- FERC & NERC regulatory requirements
- NESC & ASCE standards
- Accessibility and safety
- Public comments

Construction & Maintenance 04
- Specific route – may be in multiple states

Variation in type of entities that conduct and benefit from planning stages

TRANSPORTATION

01

02

03

04

Transportation agencies (state DOT, MPO) involved throughout process

Designed for public and societal beneficiaries

TRANSMISSION

01

02

03

04

Constellation of authorities, public and private sector

Designed to benefit system performance, industry coordination, markets and competition

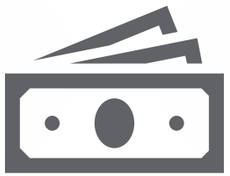
Variation in financing and capital that influence planning structures

TRANSPORTATION

01 02 03 04

Funding from federal, state, and local government

Public investment is patient and pre-determined



TRANSMISSION

01 02 03 04

Funding sources vary, but typically private capital and/or rate based

Private capital is market- and time-sensitive

Geographic and jurisdictional boundaries are different

TRANSPORTATION

01 Long-range Planning
- State DOT- or MPO-wide
- Vision/connection with broader goals; may include specific projects
- 20-25 years

02 Planning occurs within state DOT and Metropolitan Planning Organization (MPO) boundaries

03 Established and recognizable governance and spatial jurisdictions

04

TRANSMISSION

01 Planning
- Multi-state region (ISO/RTO)
- Paths/connecting zones
- Utility resource planning for load / build forecasts
- 5-30 years

02 Planning occurs within system operator or utility footprints

03 Unique boundaries that can change over time, utility drivers include access to generating resources and markets

04

Specific project design decisions are not well aligned on planning timelines

TRANSPORTATION

01 Long-range Planning
- State DOT- or MPO-wide
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02 Programming
- State DOT- or MPO-wide
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03 Project Development
- Specific project/location
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04 Construction & Maintenance
- Specific project/location
- Includes utility coordination and relocation

Key inputs about Tx in ROW would be <u>needed</u> 20 years before construction

TRANSMISSION

01 Planning
- Multi-state region (ISO/RTO)
- Paths/connecting zones
- 5-30 years

02 Siting
- Project proponent (utility, federal PMA, merchant)
- Specific route – may be multiple states
- NEPA, permitting

03 Engineering Design
- NESC & ASCE standards
- Accessibility and
- Public comments

04 Construction & Maintenance
- Specific route – may be in multiple states

Key inputs about Tx in ROW are <u>available</u> 1-5 years before construction

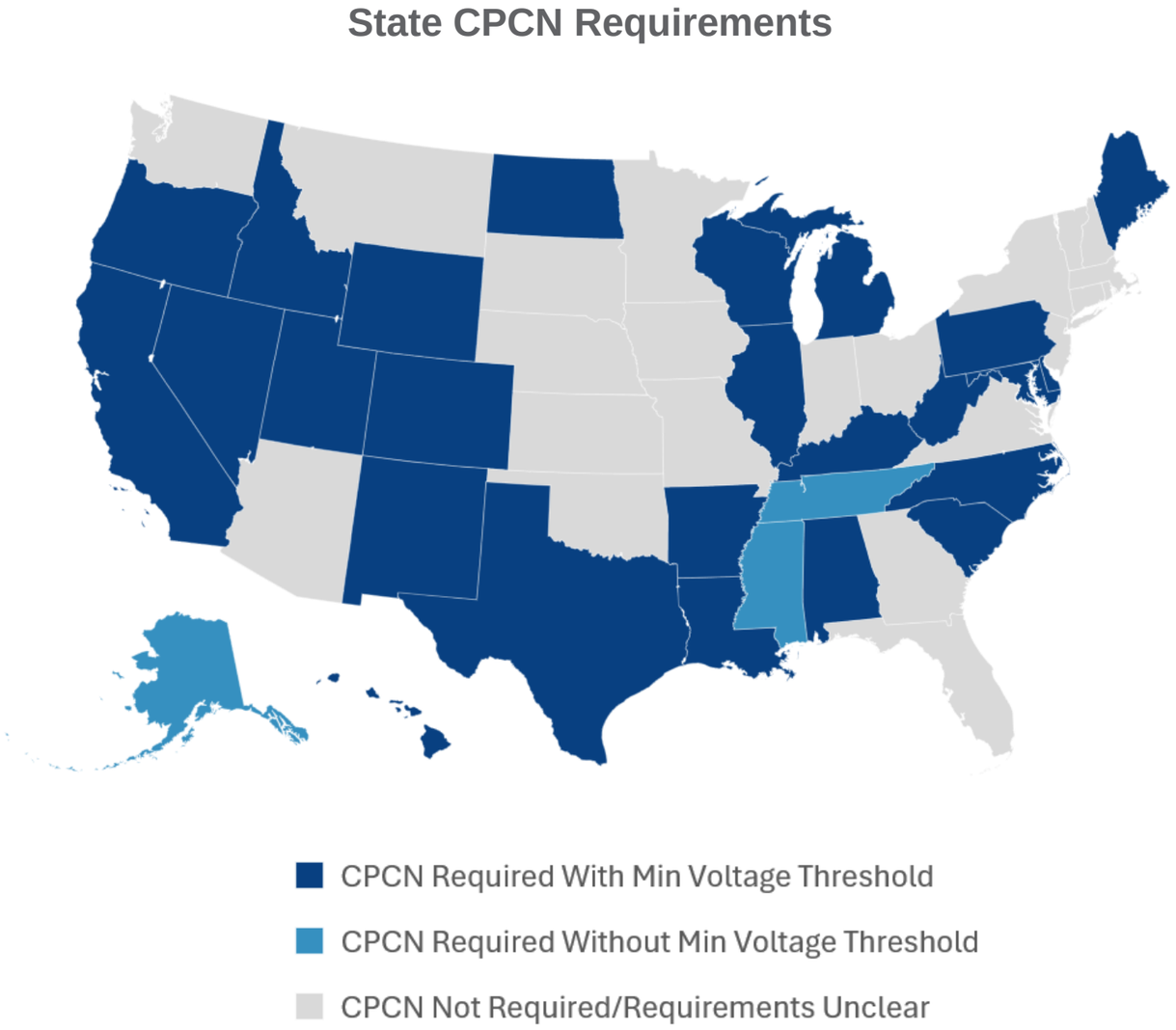
05

Siting & Permitting

Authorizations and jurisdictions for project development in ROWs

Transmission siting authorities are state-specific and highly variable

- A Certificate of Public Convenience and Necessity (CPCN) is a type of regulatory compliance certificate intended to demonstrate public need and authorize infrastructure projects.
- Siting authority varies by state. Some distribute authority over multiple agencies, while others are more centralized and coordinated.
- If centralized, government authorities primarily responsible for siting may include:
  - Public Utility Commissions (PUCs)
  - State Energy Offices
  - State Natural Resources Agencies
  - Independent State Siting Councils
  - State Siting Boards organized under an existing agency



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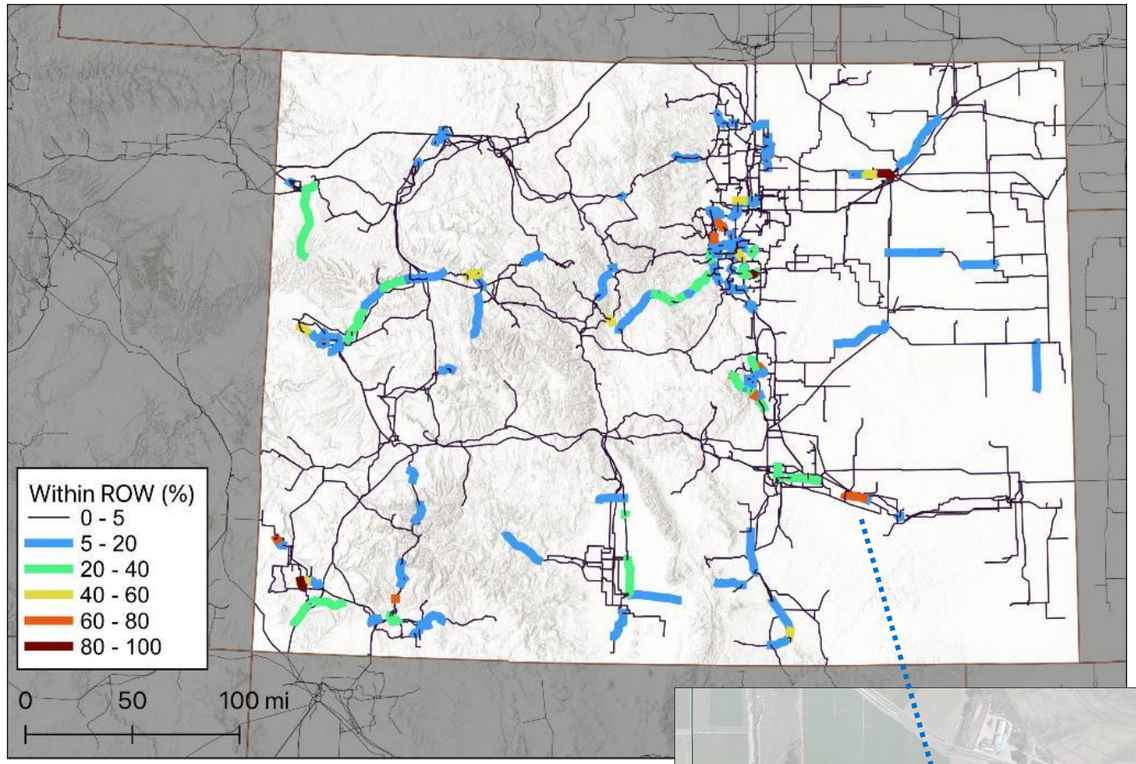
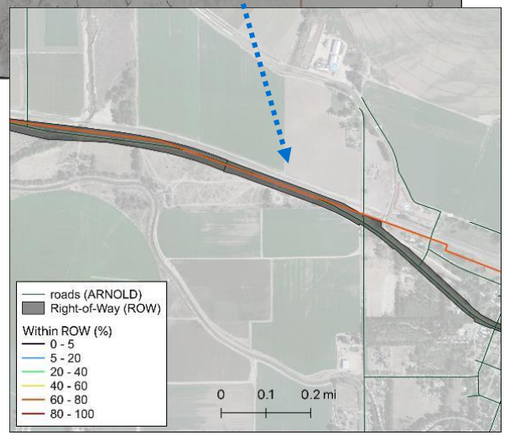
ROW data is inconsistent across states and unavailable for energy infrastructure planning

- Transportation ROW data is managed independently by state DOTs.
- Transmission is already present within highway ROW – but exactly how many structures and miles is unknown.
- Colorado DOT publishes high-quality, publicly accessible ROW data, making analysis possible.
- Colorado has 23,000 miles of transmission; 234 miles (1%) are located in Colorado DOT ROW.



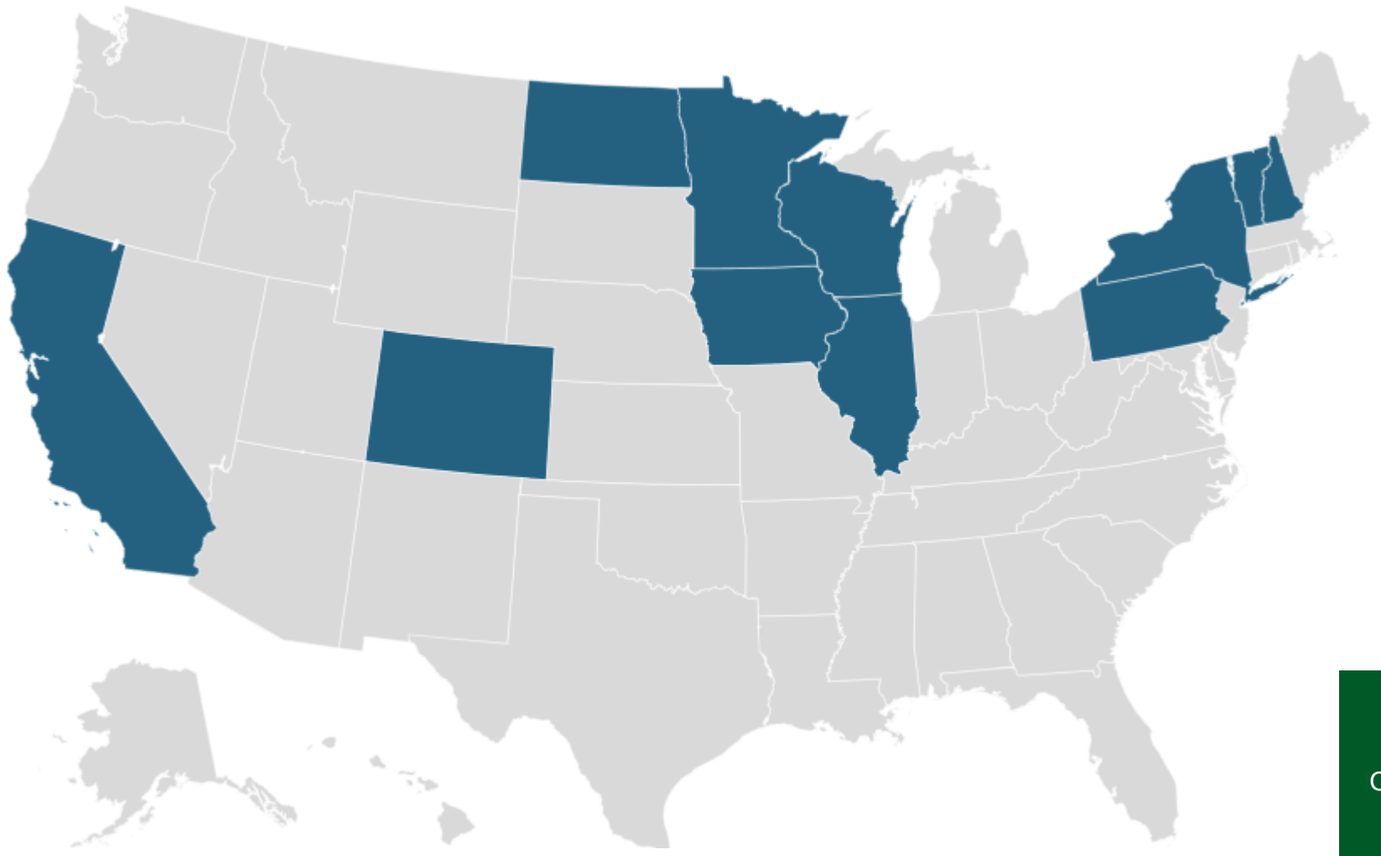
Highway type	Miles of co-located transmission	Number of co-located segments
Interstates & other freeways	49	61
Other principal and minor arterials	67	91



This transmission line has 68% of its length within a highway ROW

Identifying recent longitudinal projects within the transportation ROW (2000-2025)

States with One or More Identified Project



Key Insights from 15 Projects Identified

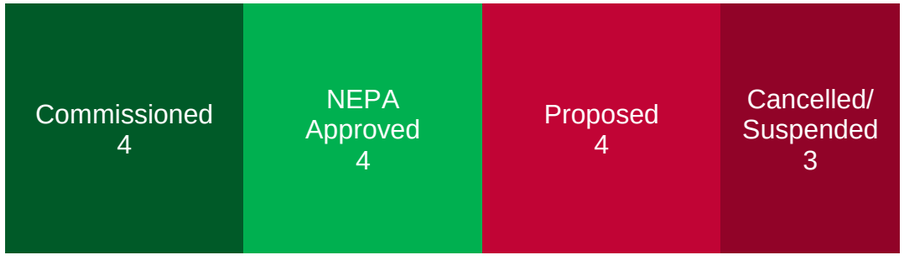
Voltage Level
All projects are 115 kV or greater.

HVDC
5 projects are high-voltage direct current (HVDC).

Orientation
8 projects are underground and 7 are overhead in the transportation ROW.

Project Financing
6 projects are merchant and 9 are non-merchant.

Status of Projects



06

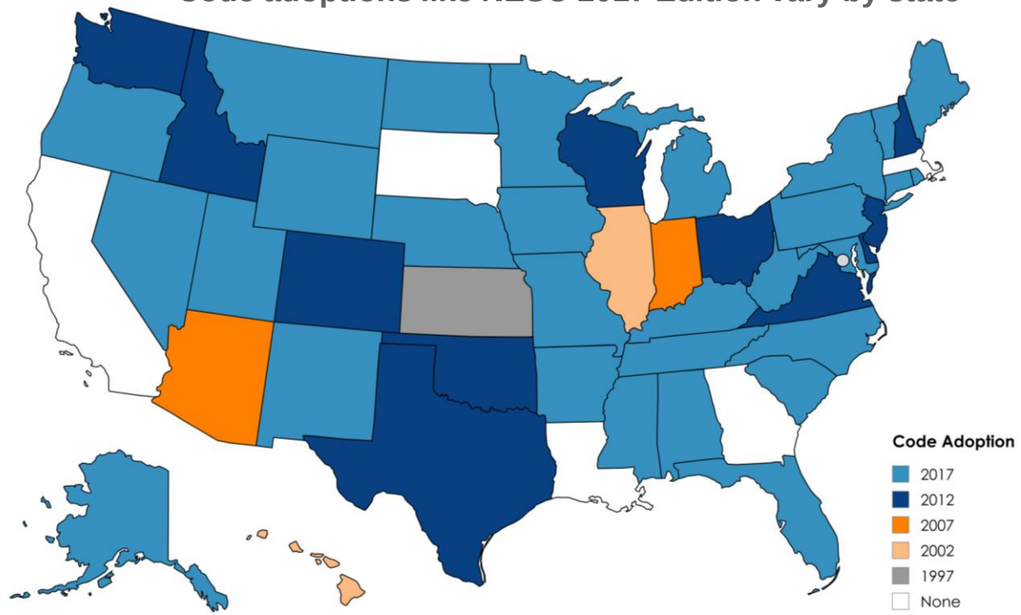
Engineering

Complex design, construction, and operations, in compliance with codes and regulations

National-level codes, standards, and regulatory requirements for transmission

- **National Electric Safety Code (NESC)** focuses on large power systems that supply power to homes and businesses.
- **American Society of Civil Engineers (ASCE)** has guidelines for Electrical Transmission Line Structural Loading and supports the design and maintenance of transmission infrastructure.
- **American National Standards Institute (ANSI) and Institute of Electrical and Electronics Engineers (IEEE)** publishes standards that cover transmission line design, voltages, levels, conductor types, thermal ratings, loading, sag, tension, and more.
- **Federal Energy Regulatory Commission (FERC)** establishes the procedural requirements that transmission planning processes must follow.
- **North American Electric Reliability Corporation (NERC)** sets and enforces reliability standards that transmission plans must meet.
  - TPL-001-2: Transmission Planning Performance
  - FAC-003-4: Transmission Vegetation Management

Code adoptions like NESC 2017 Edition vary by state



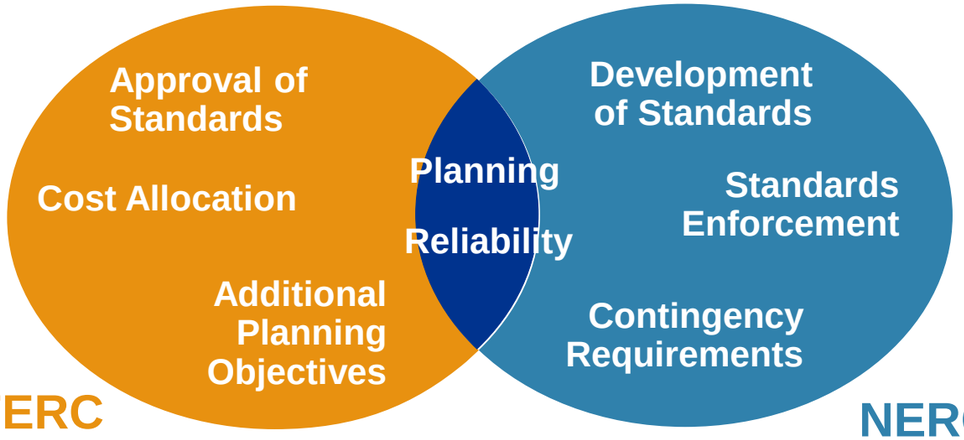
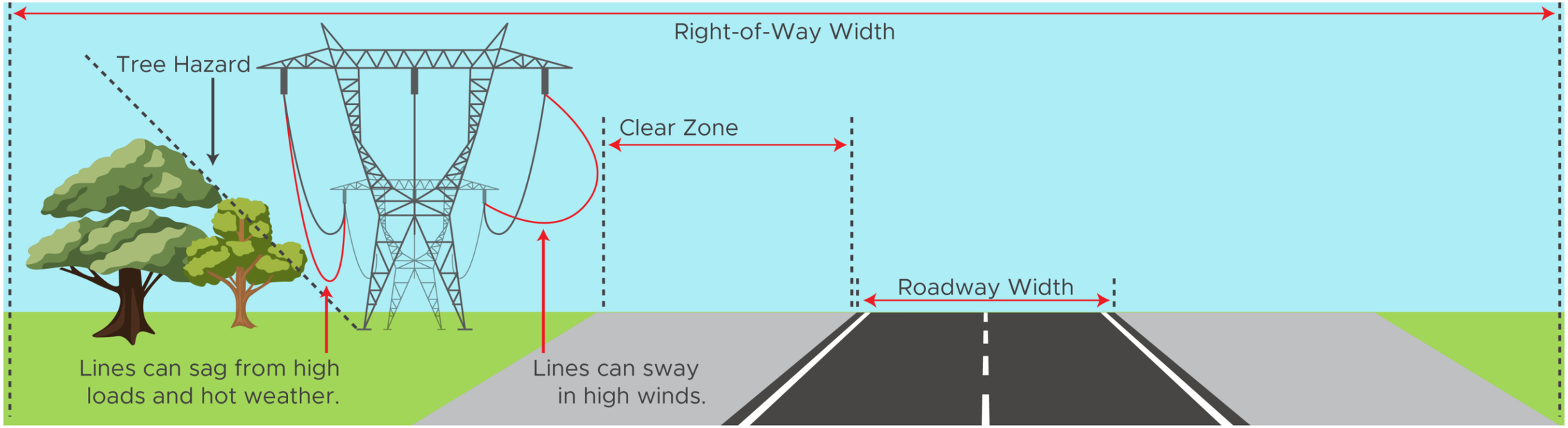


Image References:
Transmission Planning FERC NERC, PNNL-SA-202116
https://standards.ieee.org/wp-content/uploads/import/documents/other/2017-nesc-state-adoption-reference-maps.pdf

Prioritizing safety in design for transmission and transportation



Safety considerations for **transmission** system design

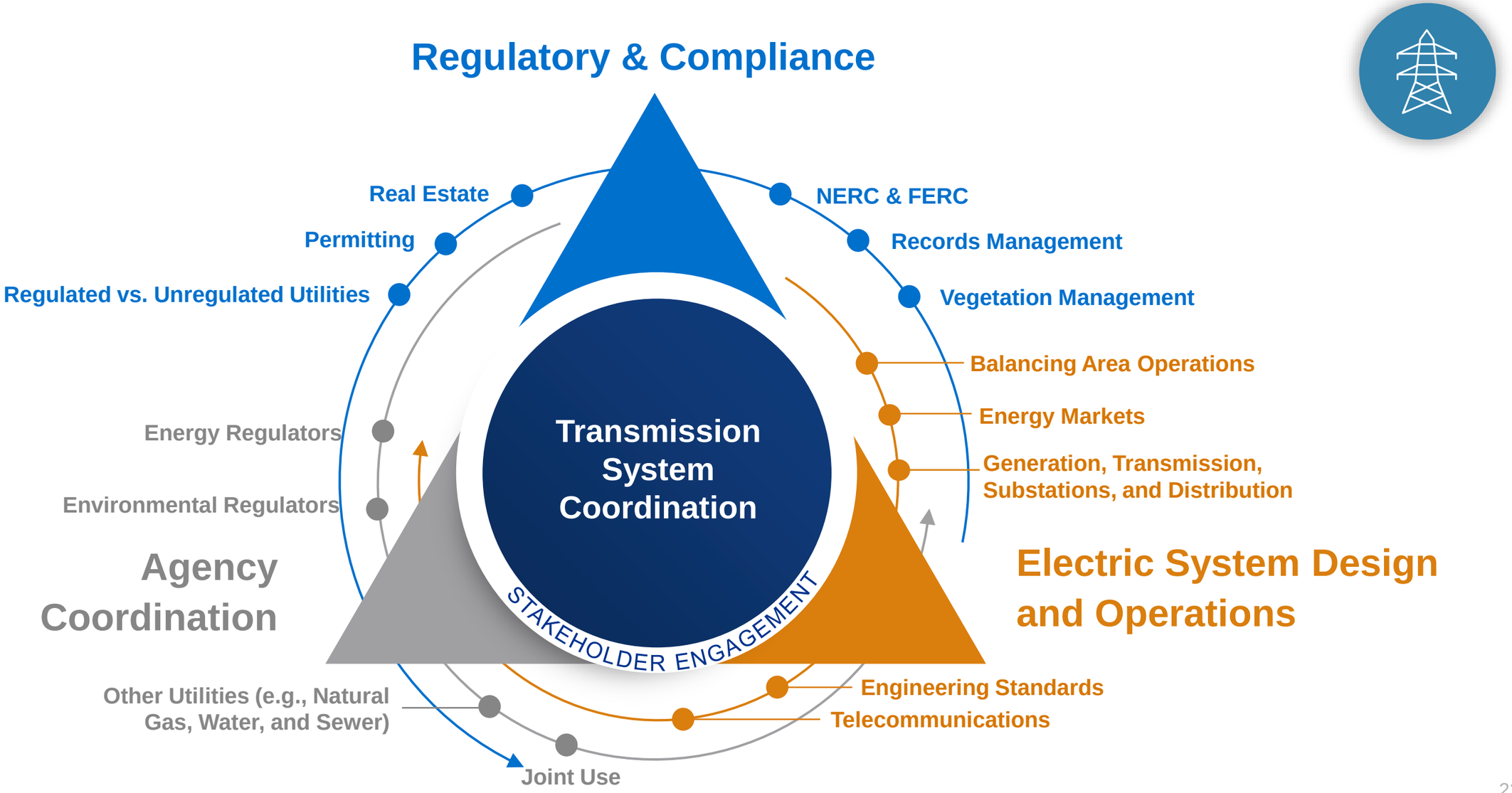
- Structure heights, types of conductors, spans, and sags are calculated to meet code requirements that include vertical (ground) and horizontal clearances for safety.
- **Span**: The distance, generally measured horizontally, between two points. Unless otherwise stated, span usually refers to the distance between two adjacent structures.
- **Sag:** The relative vertical distance of the straight line made by two adjacent supports to a point along a conductor.

Safety considerations for **transportation ROW**

- **Clear Zone:** A Clear Zone is an unobstructed, traversable roadside area that allows a driver to stop safely,or regain control of a vehicle that has left the roadway.
- **Construction, Operations, and Maintenance / Work Zones:** Areas used to separate active construction from traffic characterized by traffic pattern changes, narrowed rights-of-way, the presence of construction workers, and work vehicles frequently entering and leaving construction areas

References:
Guidelines for Electrical Transmission Line Structural Loading- ASCE Appendix A
US Department of Transportation FHA- Clear Zones

Grid planning, construction, and operation already requires extensive coordination by design



Accessibility of transmission corridors includes easements on private property, considerations for sizable equipment, and safety aspects for road crossings

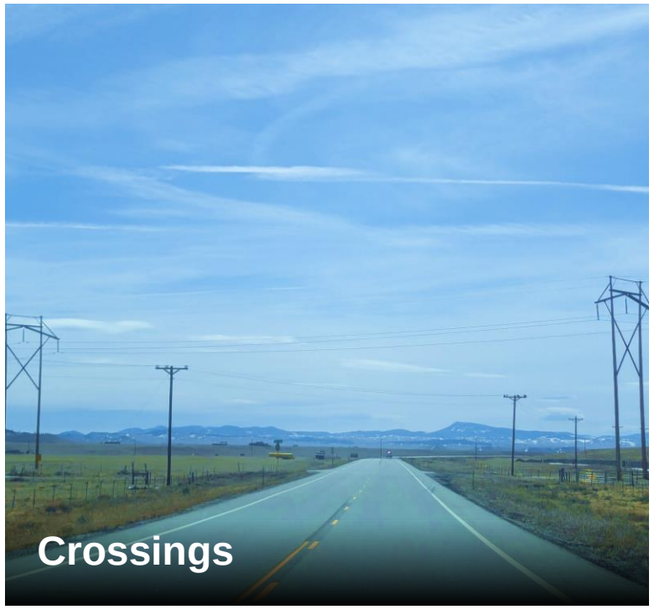


Image Credits:
Transmission with Rail: Scott Gilman, Colorado
Vegetation Clearances: Irena Netik, Washington
Crossings: Scott Gilman, Colorado
Property Easements: Rebecca O'Neil, Kentucky

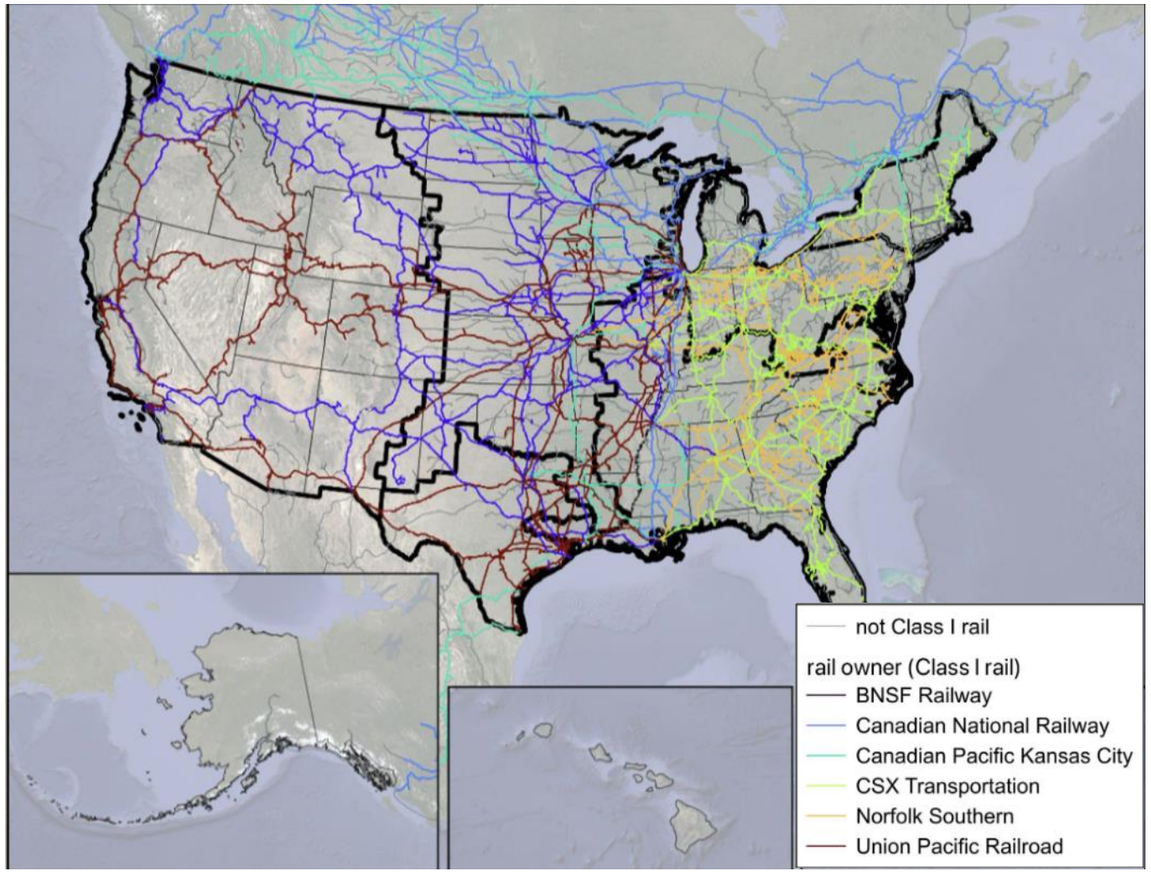
07

Rail

Each rail owner requires license agreements and has independent policies and procedures

Class I railroads have national reach for transmission opportunities

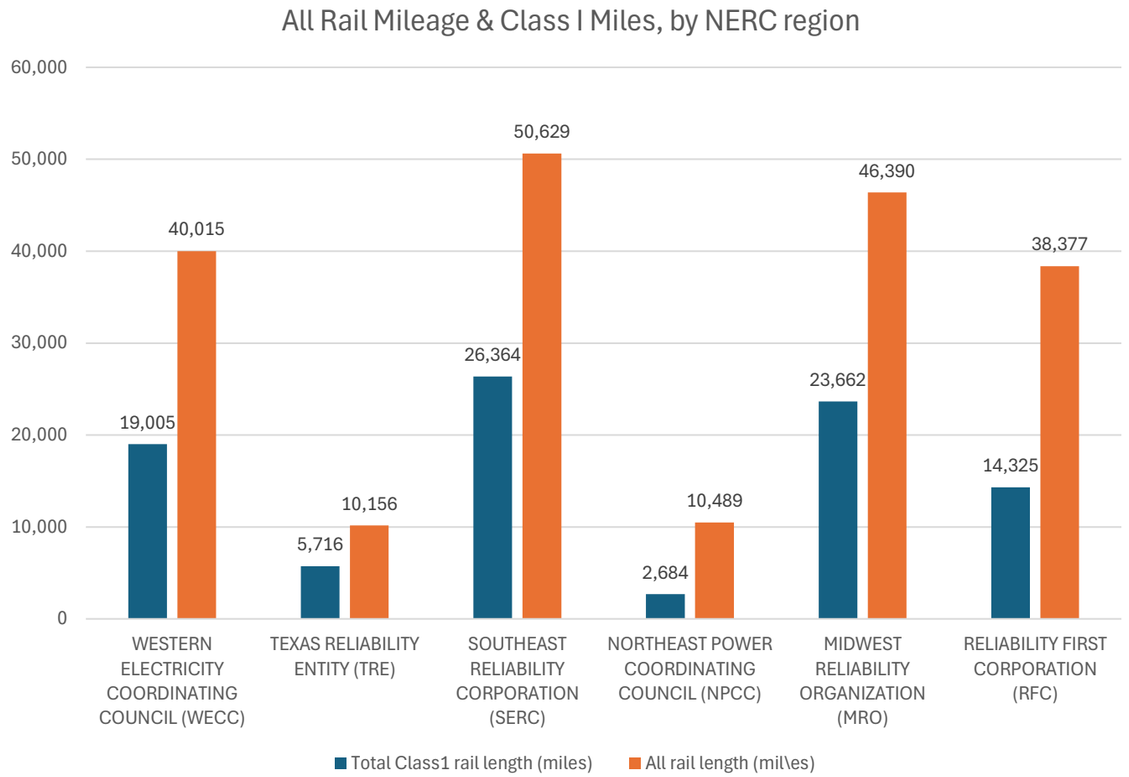
- Freight railroads in the U.S. are designated according to their annual operating revenues as Class I, II, or III.
- Approximately **two-thirds** of the nation's rail network (~92,000 route miles) is **owned by six Class I freight railroad** companies.
- Class II and III make up 600 short line railroads and include private, public, and quasi-public operators and owners.
- Railroad property rights often come from easements, license agreements, and/or adverse possession.



Above: Class I rail owners related to NERC regions. Note that all bulk electric reliability regions have Class I rail opportunities.

Rail right-of-way requirements and prohibitions; Class I regional distribution

- Railroad companies have individual requirements for development in their rights-of-way.
- Common requirements:
  - Minimum distance to centerline of track and communication and signal lines
  - Minimum vertical clearance
  - Minimum depth
  - Encasement material
  - Inductive interference coordination study
- **Two of the Class I rail owners (BNSF and CP) have restrictions within their utility policies for high voltage towers in the ROW (overhead installations).**

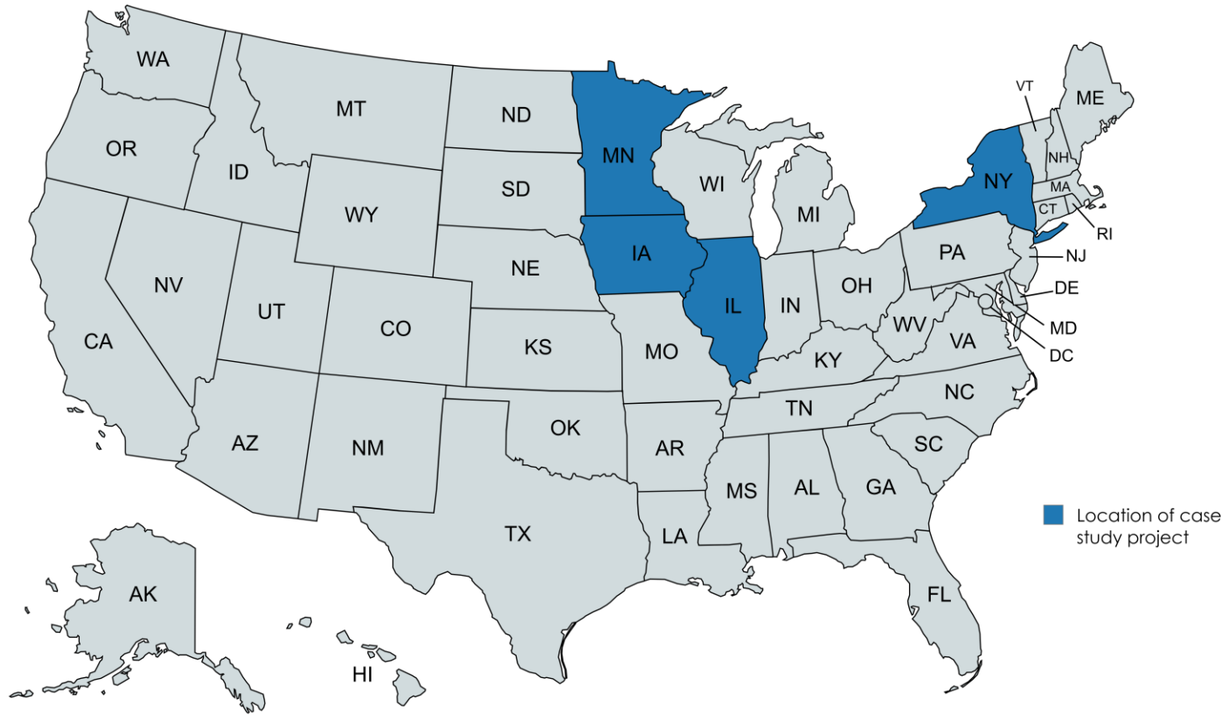


Case Studies

The Volpe Center has prepared a series of draft case studies that highlight opportunities for transportation agencies to site energy projects on their properties and rights-of-way.

Case Studies

- The Volpe Center has prepared a series of draft case studies that highlight opportunities for transportation agencies to creatively streamline permit processes, reap financial benefits, and increase grid reliability by siting energy projects on their properties and rights-of-way.
- Three transmission projects featured:
  - SOO Green HVDC Link (Iowa & Illinois)
  - Champlain Hudson Power Express (New York)
  - Minnesota NextGen Highways (not covered in this presentation)



Case Study Project Locations

Case Studies: SOO Green HVDC Link

Project Summary

- Planned 350-mile HVDC transmission line from Mason City, Iowa, to Plano, Illinois
  - 158 miles co-located in CPKC Railway ROW
  - 16 miles co-located with U.S. Highway 18 in Iowa
- Will connect electricity markets by bringing power from the Midwest (MISO) wind resources to the mid-Atlantic (PJM)

Challenges & Lessons Learned

- Bipolar, DC current minimizes risks to railway safety
- Unclear railway property rights may complicate easement acquisition
- Stakeholder engagement, including one-on-one meetings between Iowa DOT and the developer, helped to move the project forward

Case Studies: Champlain Hudson Power Express

Project Summary

- Planned 340-mile HVDC transmission line from Quebec to New York City
  - 60% underwater in Lake Champlain and the Hudson River
  - 40% in highway and railroad ROW
- Will connect Canadian hydroelectric power with demand in New York City

Challenges & Lessons Learned

- Physical limitations of HVDC technology, such as limited bend radius, may complicate finding the proper alignment within the ROW
- Piecemeal design submission can complicate review

Case Studies: Summary

Solutions to Common Challenges

- Ensure strong collaboration and coordination between public agencies.
- Proactive stakeholder engagement can identify potential conflicts in right-of-way along with solutions to design and construction challenges.
- Proactive public engagement can help the public better understand the project and build trust.
- Transportation agencies and developers can work together to structure a deal that addresses common concerns on both sides.

Common Lessons Learned

- Siting transmission infrastructure in transportation rights-of-way can save time and money compared to developing outside of ROWs.
- Environmental mitigation can help to garner support for such projects.
- Cultivating cross-disciplinary expertise can help overcome siloes.
- State-level energy goals motivate transmission and solar projects in the right-of-way.

Contacts

Volpe

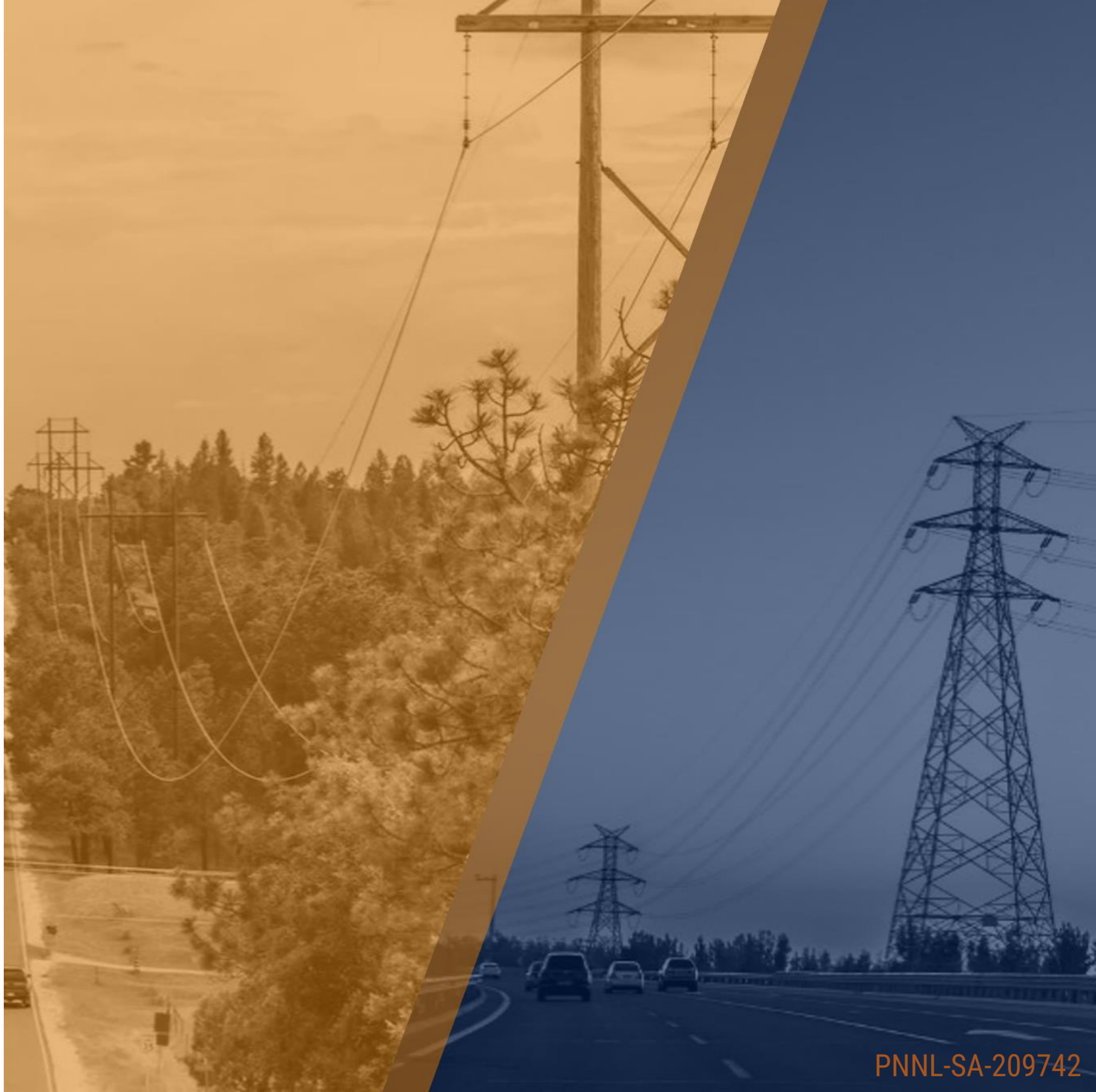
Amy Plovnick
amy.plovnick@dot.gov

Scott Gilman
scott.gilman@dot.gov

PNNL

Rebecca O'Neil
rebecca.oneil@pnnl.gov

Jennifer Yoshimura
jennifer.yoshimura@pnnl.gov



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