



EESI

Environmental and
Energy Study Institute

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Powering Up: Improving Energy Grid Reliability and Resilience to Lower Energy Bills

Thursday, October 9, 2025

About EESI



Nonpartisan Educational Resources for Policymakers

A bipartisan Congressional caucus founded EESI in 1984 to provide nonpartisan information on environmental, energy, and climate policies



Direct Assistance for Equitable and Inclusive Financing Program

In addition to a full portfolio of federal policy work, EESI provides direct assistance to utilities to develop “on-bill financing” programs



Commitment to Diversity, Equity, Inclusion, and Justice

We recognize that systemic barriers impede fair environmental, energy, and climate policies and limit the full participation of Black, Indigenous, people of color, and legacy and frontline communities in decision-making



Sustainable Solutions

Our mission is to advance science-based solutions for climate change, energy, and environmental challenges in order to achieve our vision of a sustainable, resilient, and equitable world

Polymaker Education



Briefings and Webcasts

Live, in-person and online public briefings, archived recordings, and written summaries



Climate Change Solutions

Bi-weekly newsletter with everything policymakers and concerned citizens need to know, including a legislation and hearings tracker



Fact Sheets and Issue Briefs

Timely, objective coverage of environmental, clean energy, and climate change topics



Social Media (@EESlonline)

Active engagement on Bluesky, Facebook, LinkedIn, X, and YouTube



Upcoming Briefings



EESI
Environmental and
Energy Study Institute

Powering Up:
Improving Energy Grid Reliability and Resilience to Lower Energy Bills
Thursday, October 9, 3:30-5:00 PM

4

How Can We Cut Industrial Emissions?
Wednesday, October 22, 9:00-10:00 AM

Rapid Readout: The Future of FEMA
Thursday, October 30, 12:00-12:30 PM

What Congress Needs to Know About COP30
November 4 – 6, 12:00-1:00 PM

Sign up for our *Climate Change Solutions* newsletter here: eesi.org/signup



EESI
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What did you think of the briefing?

Please take 2 minutes to let us know at:

www.eesi.org/survey

Materials will be available at:

www.eesi.org/100925grid

Post about the briefing:

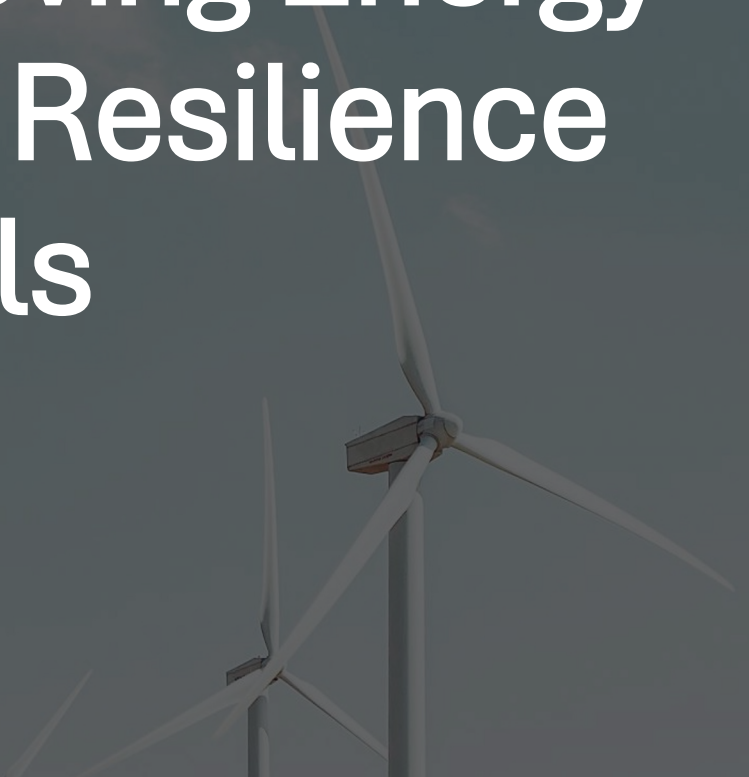
[#eesitalk](#) [@eesionline](#)

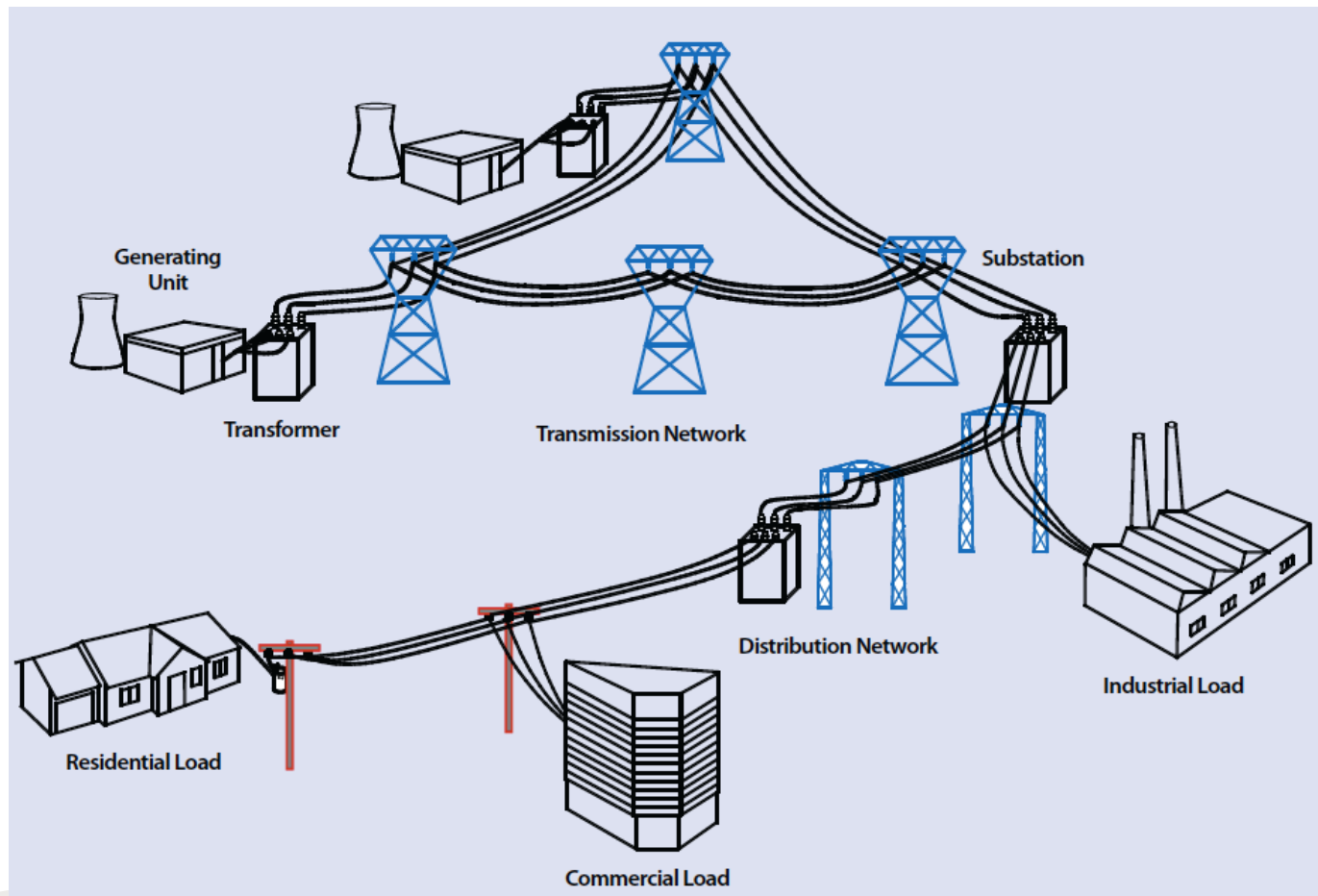


Thursday, October 9, 2025

Powering Up: Improving Energy Grid Reliability and Resilience to Lower Energy Bills

Paulina Jaramillo, Ph.D.





Every power system has several components

Some unique characteristics make the power system more “complicated” than other infrastructure

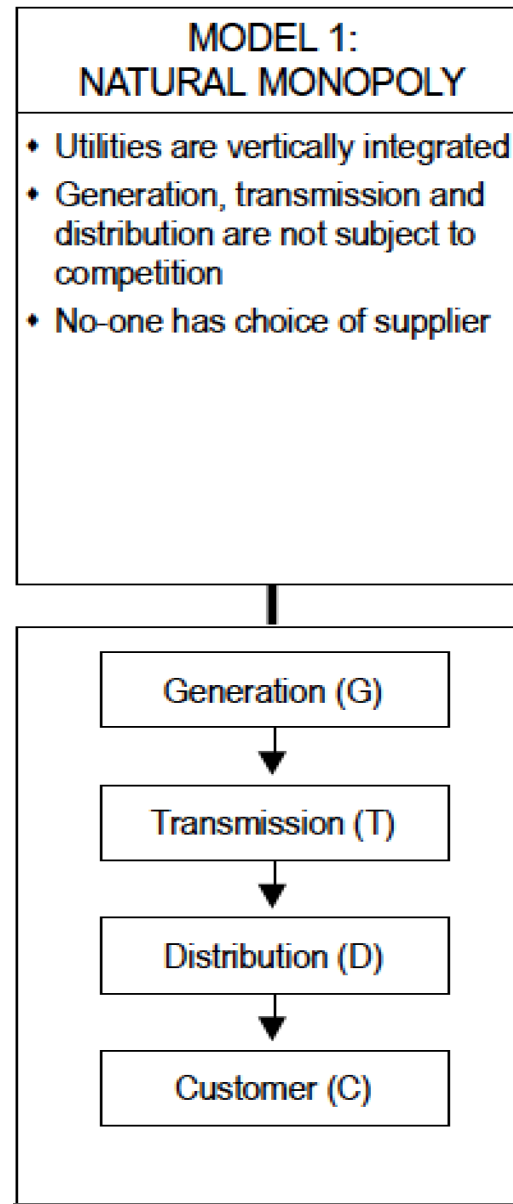
Voltage fluctuates (not steady)

Demand changes constantly (not predictable)

Transmission has physical limits (resistance, capacity)

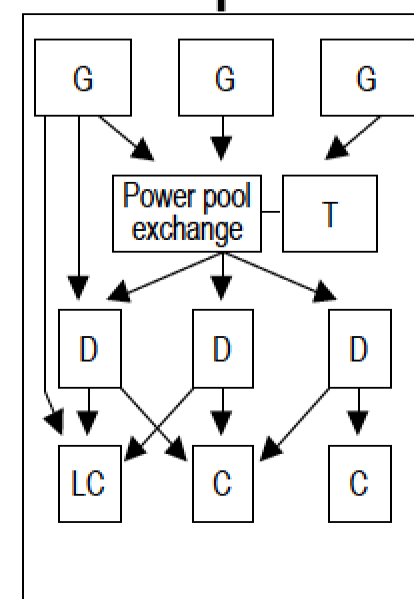
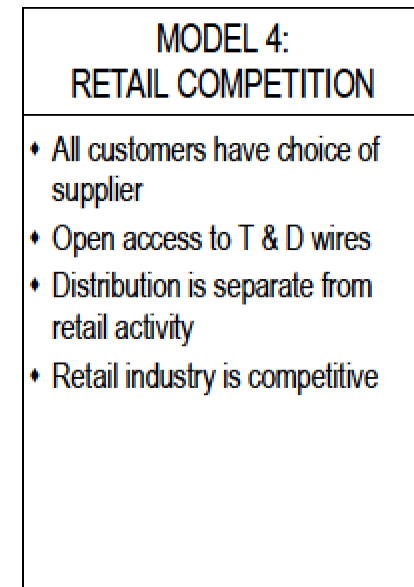
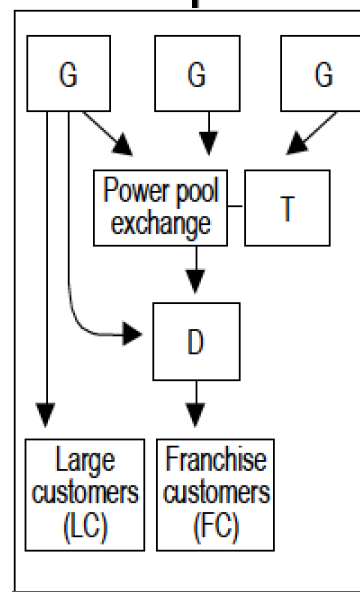
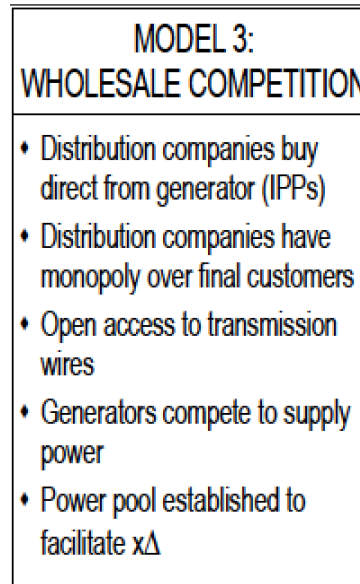
Single point of failure (no redundancy)

Historically, vertically integrated utilities managed the grid.



Restructuring of the electricity led to the creation of electricity markets

5



Regulated vs Deregulated Energy Markets



Our electricity system faces new challenges

Massive demand growth for AI

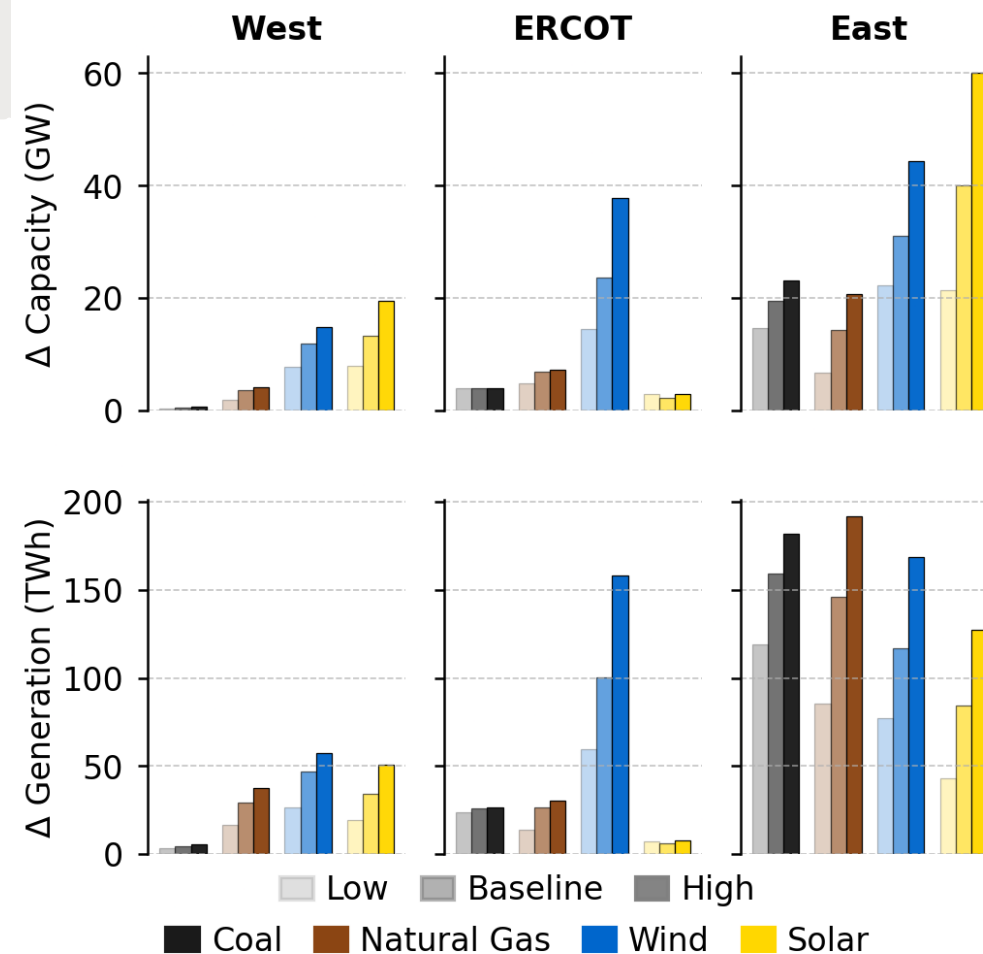
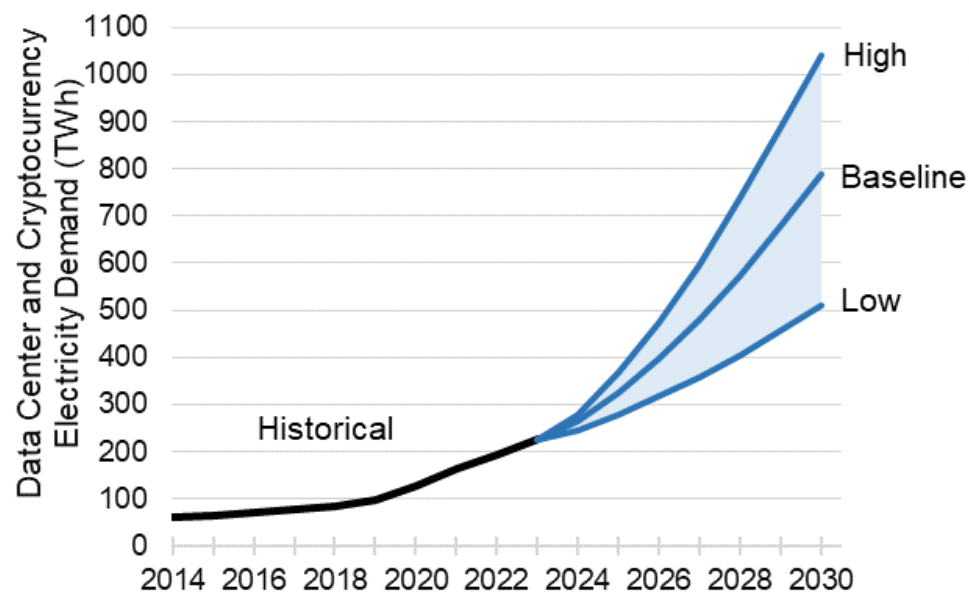
Electrification of end uses & decarbonization

Variable and intermittent resources

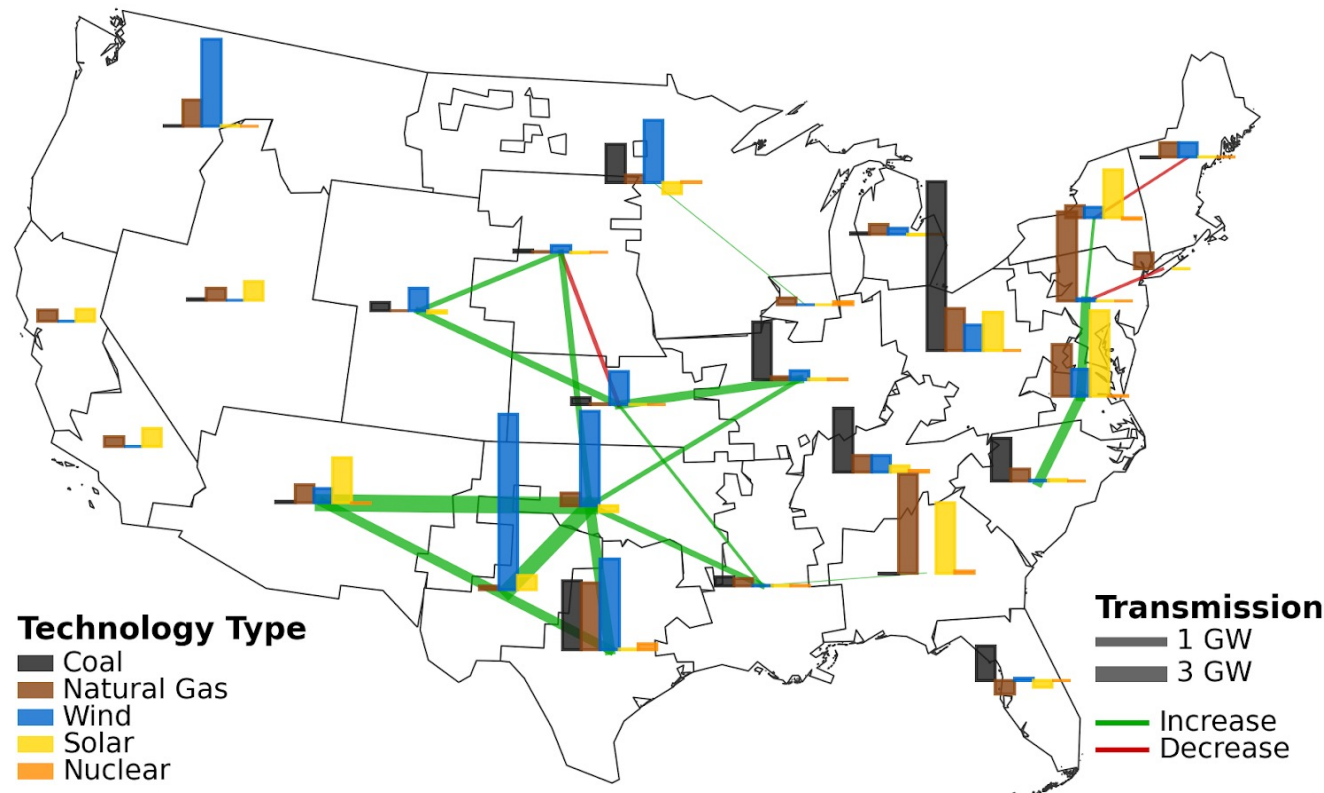
Climate risks

Aging infrastructure

Data center demand will require rapid growth in generating capacity by 2030



Meeting data center demand also requires transmission investments in the next five years



Decarbonizing the US energy system would also require doubling our generating capacity by 2050

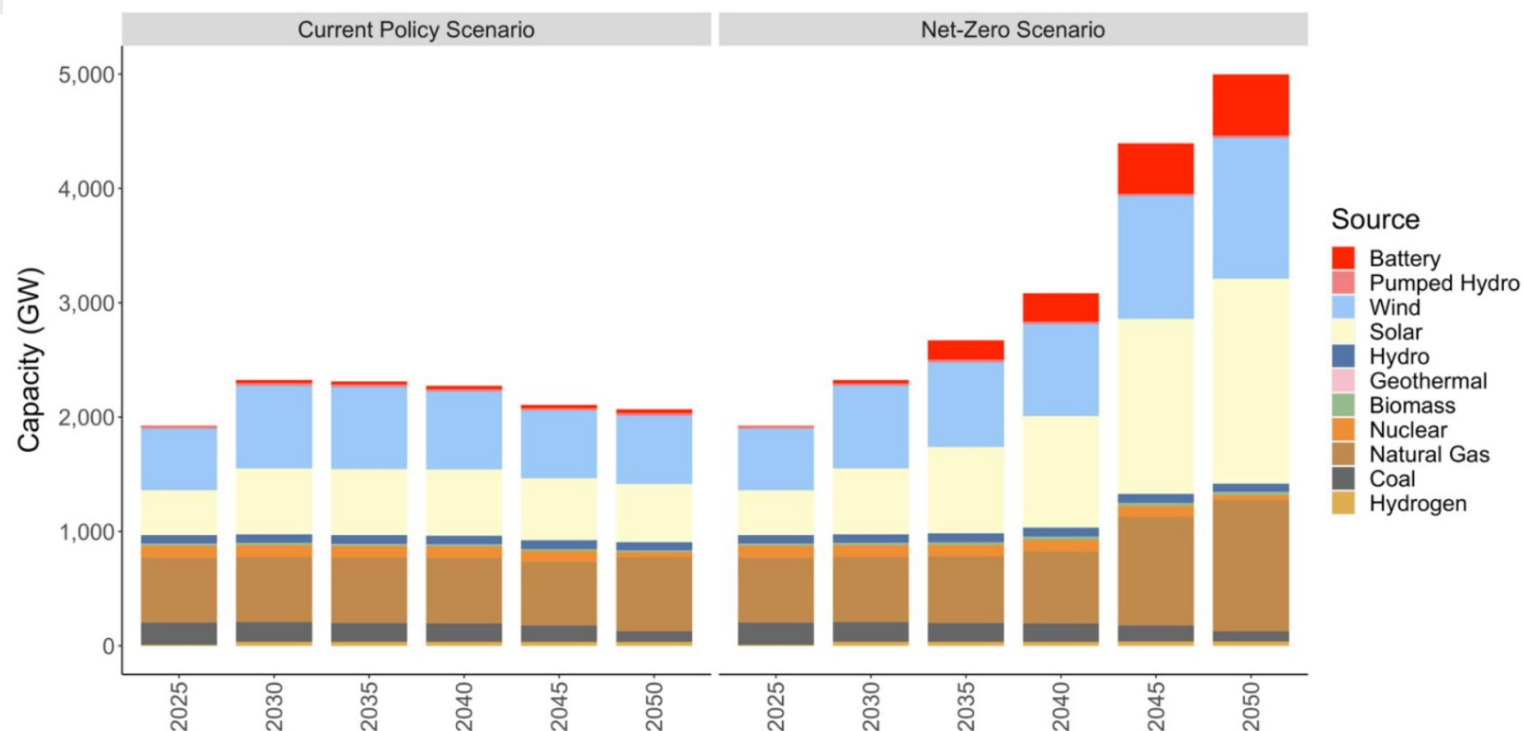


Figure 5: Electric power generation and storage capacity under each modeled scenario

There are multiple barriers to grid modernization

Inconsistent regulatory processes with multiple entities having jurisdiction

- Who is responsible for planning the grid?

Generation and transmission expansion are capital-intensive

- How are costs allocated?

Siting grid infrastructure is very challenging in the U.S.

- Permitting delays are often cited as the primary one.

Technological gaps are not the primary barrier to the grid modernization

- There are always opportunities for innovation

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PAULINA JARAMILLO, Ph.D.





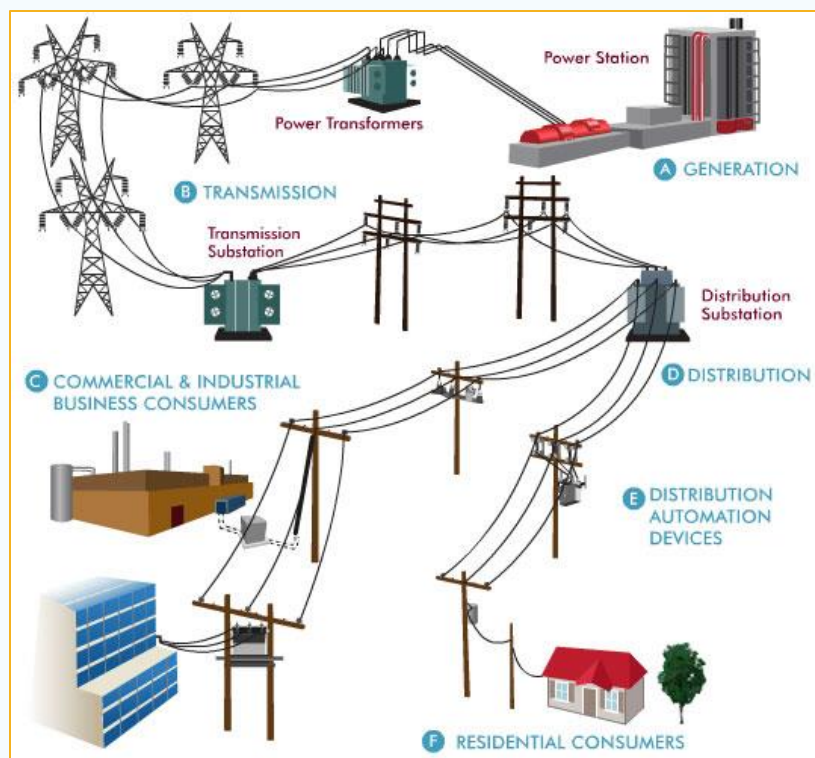
Improving Energy Grid Reliability and Resilience to Lower Energy Bills

Zach Zimmerman, Research and Policy Manager

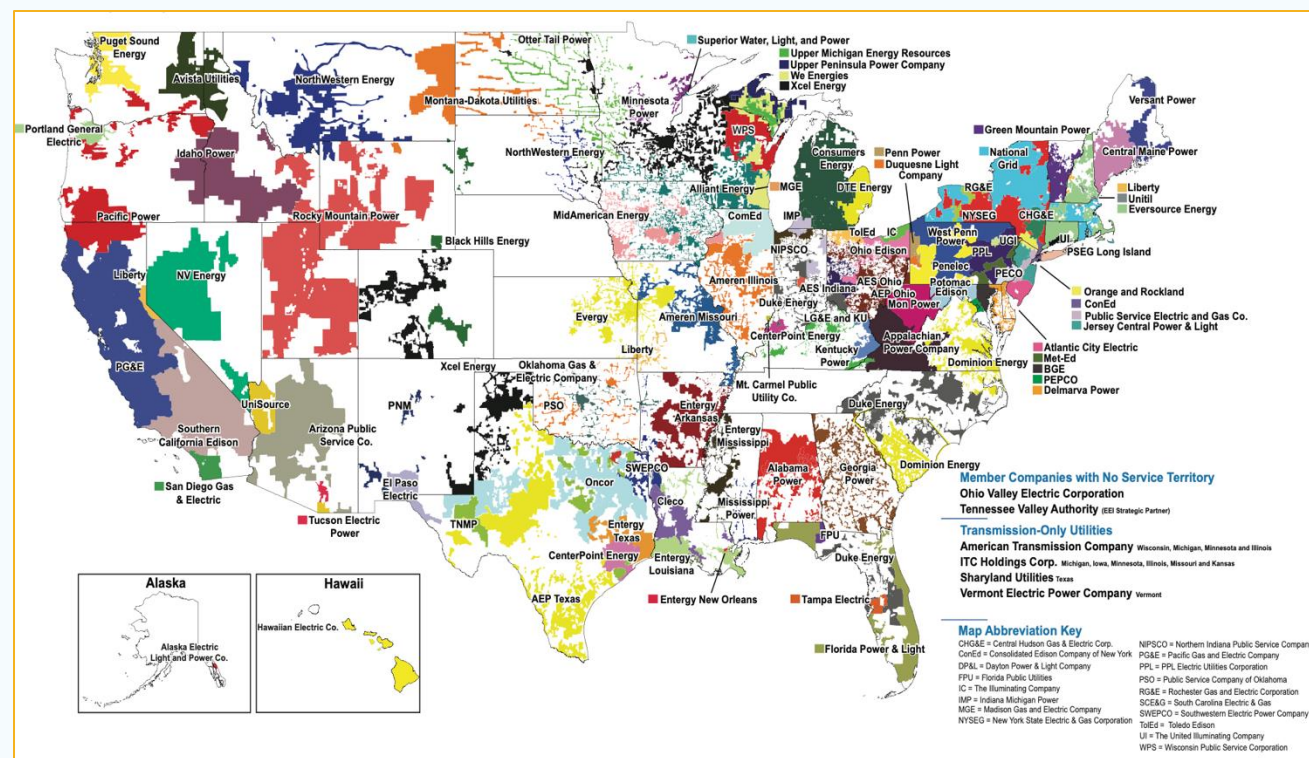
October 2025

Fragmented US utility industry not designed to build large regional networks

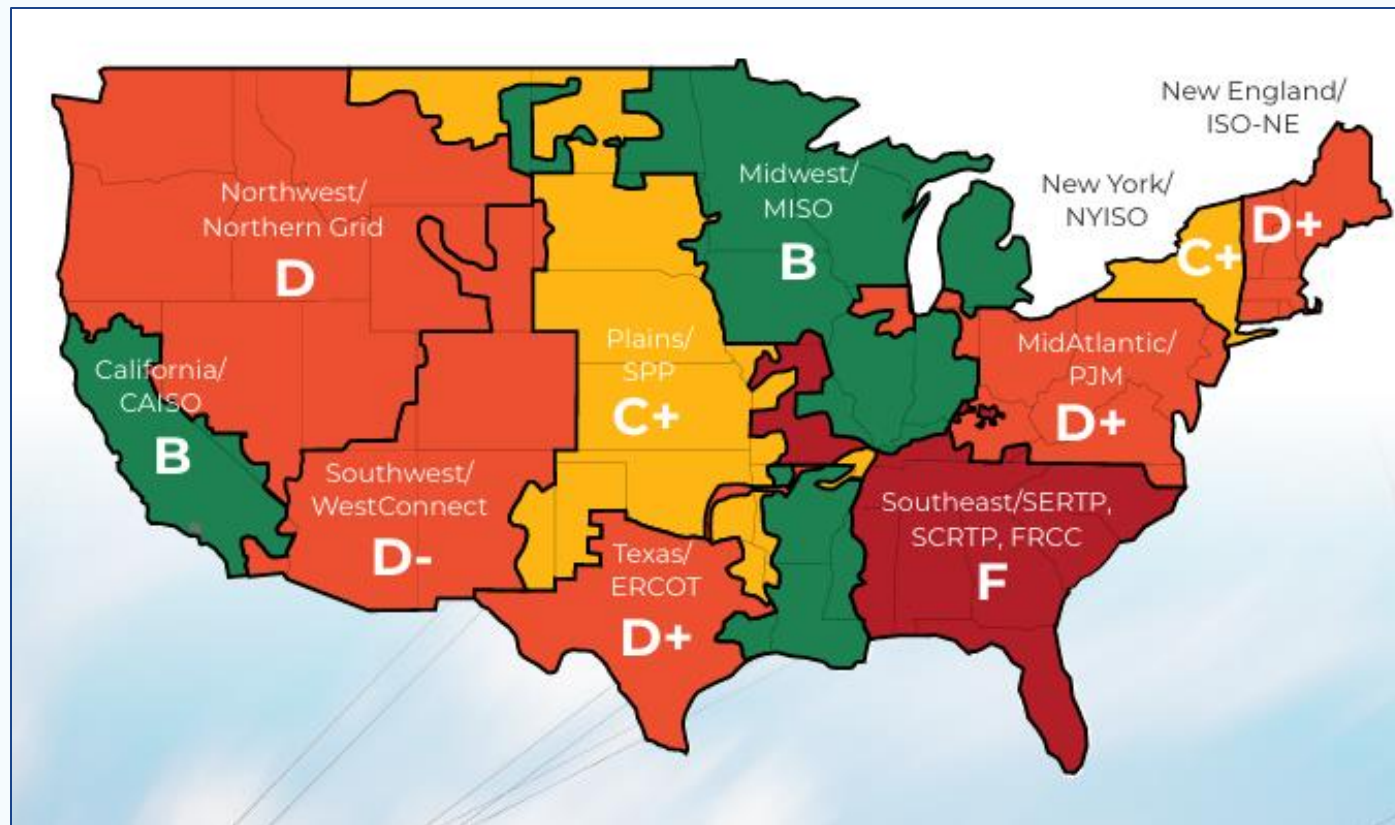
Utilities operate individual systems...



...with around 3,000 separate utilities focused on their own small footprint



Regional planning has limited success in developing new transmission



- ISO New England (ISO-NE)
- New York Independent System Operator (NYISO)
- PJM Interconnection (PJM)
- Southeastern Regional Transmission Planning (SERTP)
- South Carolina Regional Transmission Planning (SCRT)
- Florida Reliability Coordinating Council (FRCC)
- Midcontinent Independent System Operator (MISO)
- Southwest Power Pool (SPP)
- WestConnect
- Northern Grid
- California Independent System Operator (CAISO)
- Electric Reliability Council of Texas (ERCOT)*

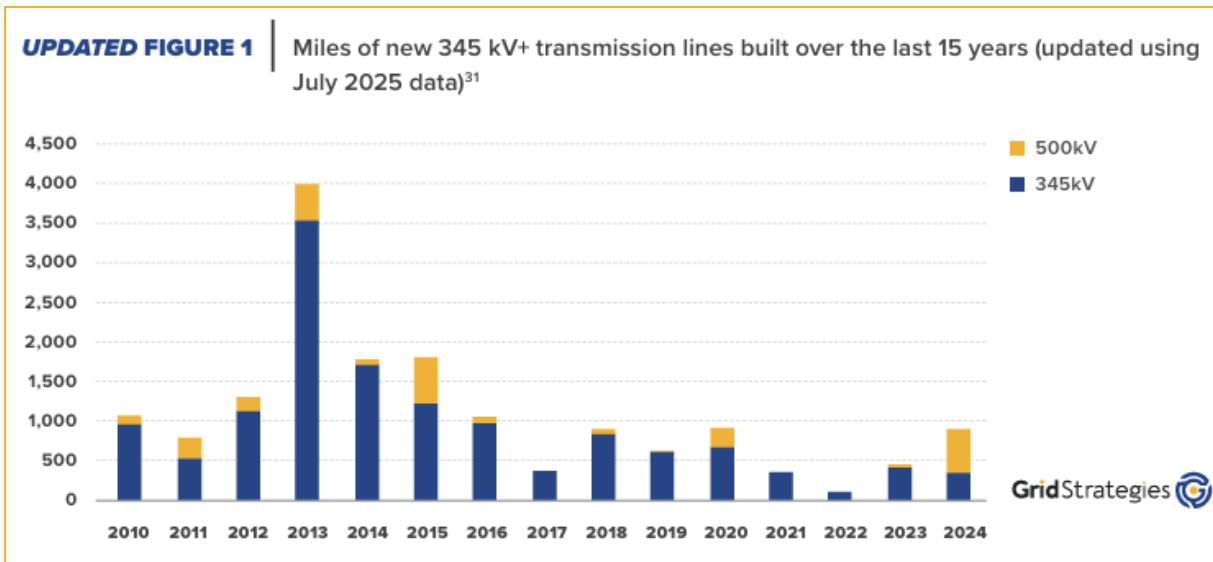
SOURCE | [ACEG Transmission Planning Report Card 2023](#)

Result: very little long-distance transmission has been built recently

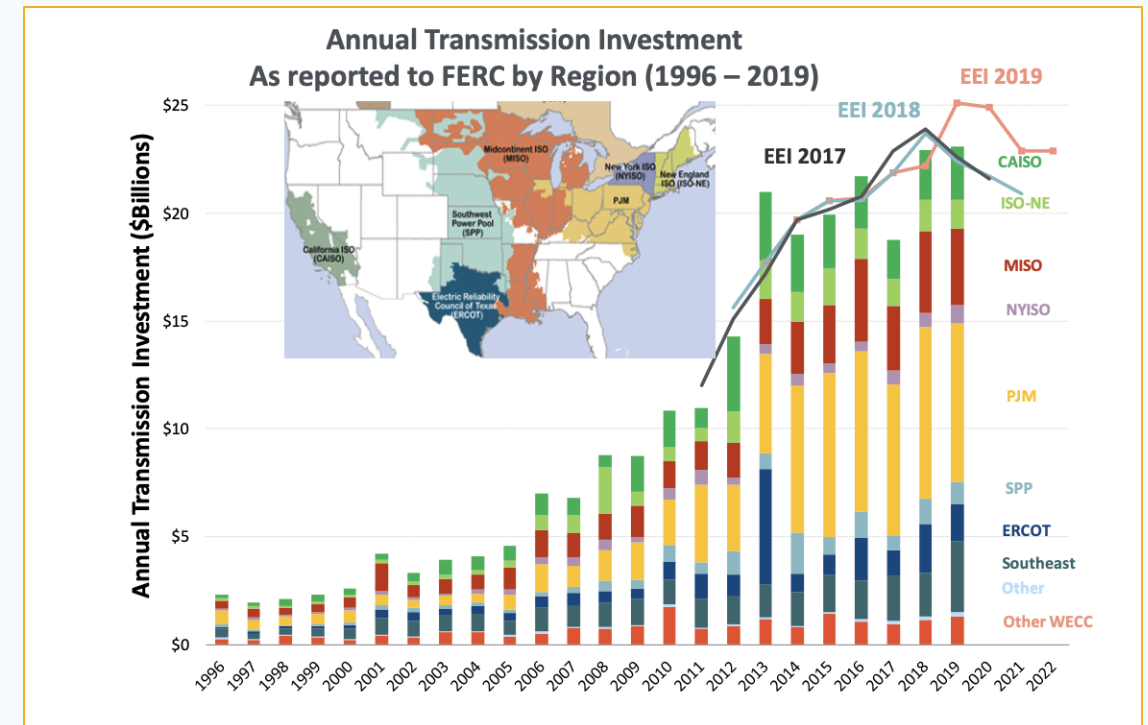
Many miles of new transmission in 2013, then dropped to a trickle...



...with investment rising but capacity not increasing—mostly replacing aging assets



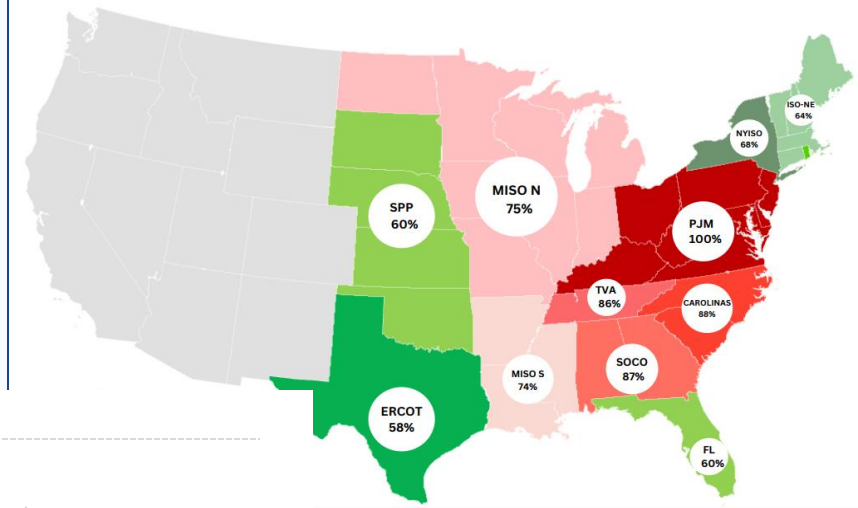
SOURCE | Grid Strategies LLC, [Fewer New Miles](#) (July 2025)



SOURCE | The Brattle Group, [Annual US Transmission Investments 1996-2023](#) (June 2024)

Transmission relieves congestion diversifies supply + demand of electricity, improving grid reliability and resilience

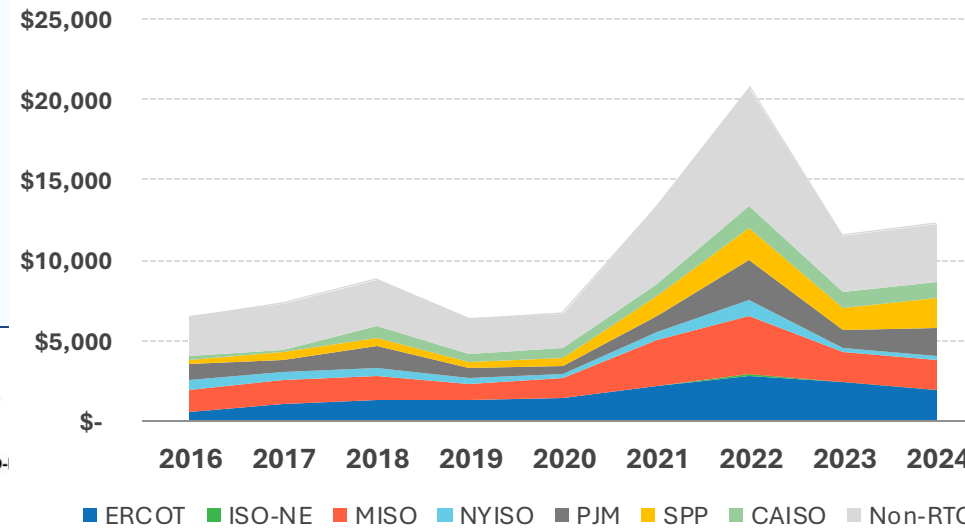
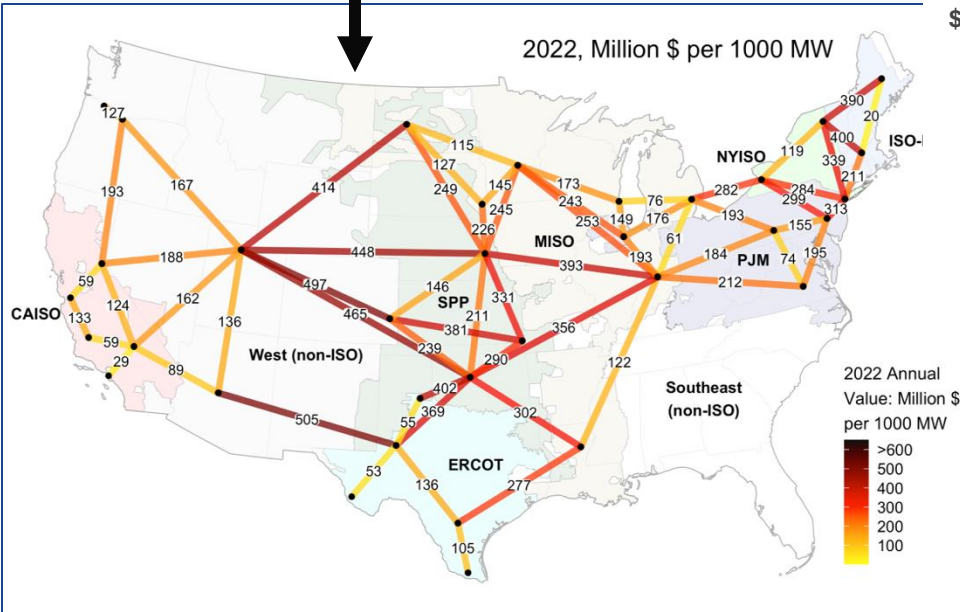
2014 POLAR VORTEX EVENT, JANUARY 17, 2014, AT 7 AM ET



Intraregional congestion



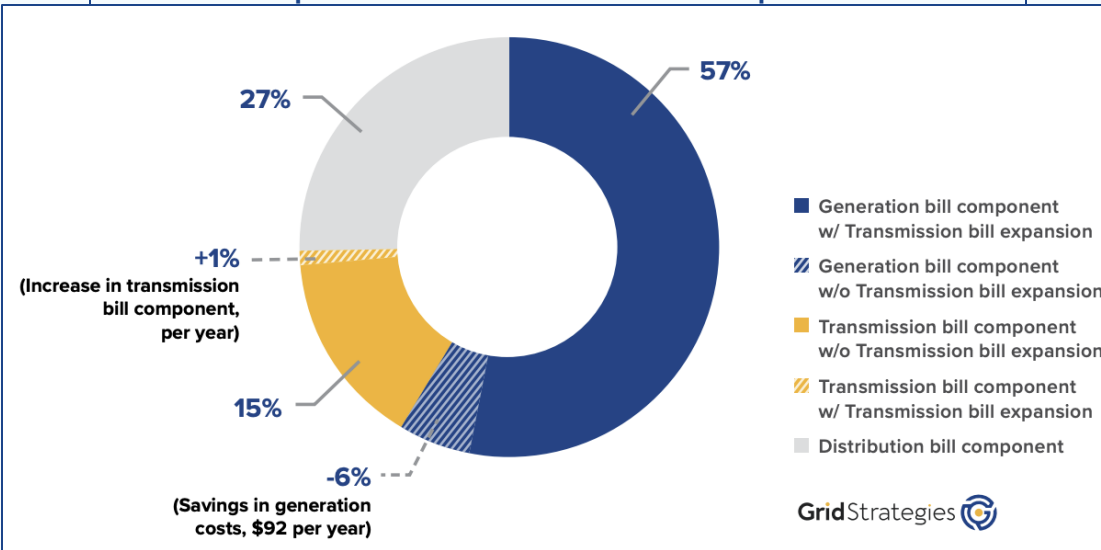
Interregional congestion



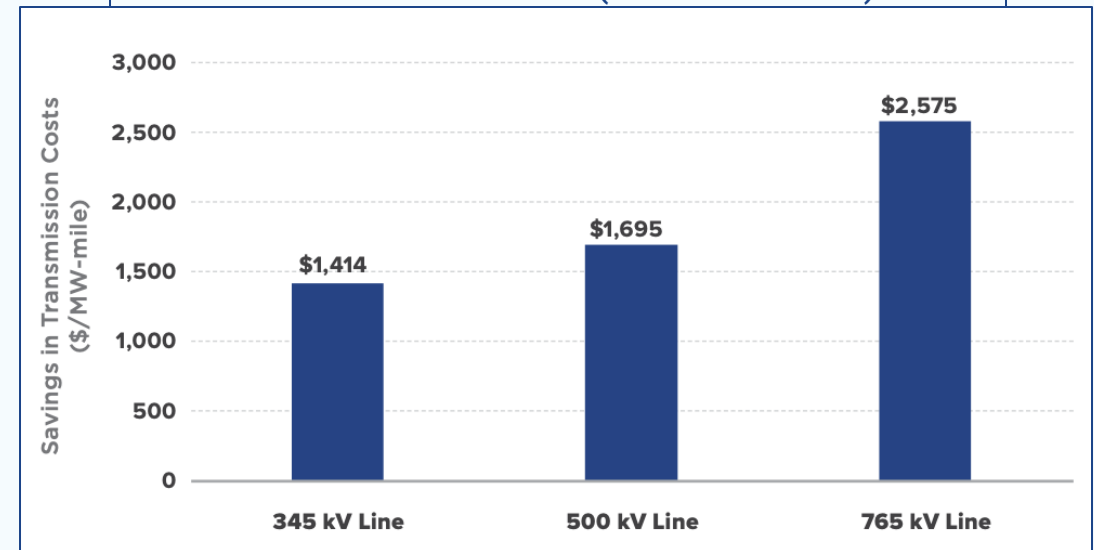
Well-planned transmission saves consumers money

Transmission expansion could save U.S. households on net \$6.3-10.4 billion annually

Components of an electric bill with and without well-planned transmission expansion



Savings (\$/MW-mi) compared to 230 kV transmission lines (Source: MISO)



Planning

The existing transmission planning paradigm has not resulted in enough transmission.

Key issues:

- Too near term
- Fails to consider all the drivers of transmission
- Fails to consider all the benefits of transmission
- Static view of the system
- Does not consider advanced technologies
- No real framework for interregional

FERC attempting to address issues with Order 1920



OFFICE OF PUBLIC PARTICIPATION
FEDERAL ENERGY REGULATORY COMMISSION

Explainer

Transmission Planning and Cost Allocation Final Rule

Building for the Future Through Electric Regional Transmission Planning and Cost Allocation, Docket No. RM21-17; Order No. 1920, Order No. 1920-A, and Order No. 1920-B

Congress
required NERC →
to study
interregional

Public Law 118-5
118th Congress

An Act

To provide for a responsible increase to the debt ceiling.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the “Fiscal Responsibility Act of 2023”.

SEC. 2. TABLE OF CONTENTS.

The table of contents for this Act is as follows:

Sec. 1. Short title.
Sec. 2. Table of contents.
Sec. 3. References.

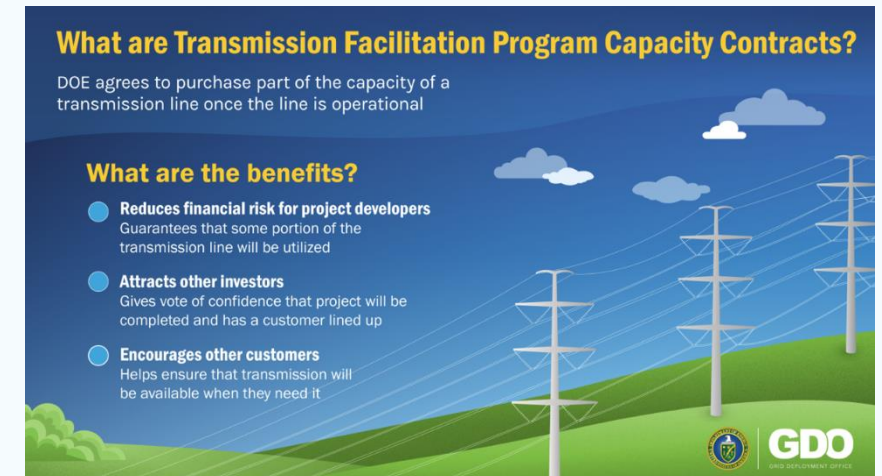
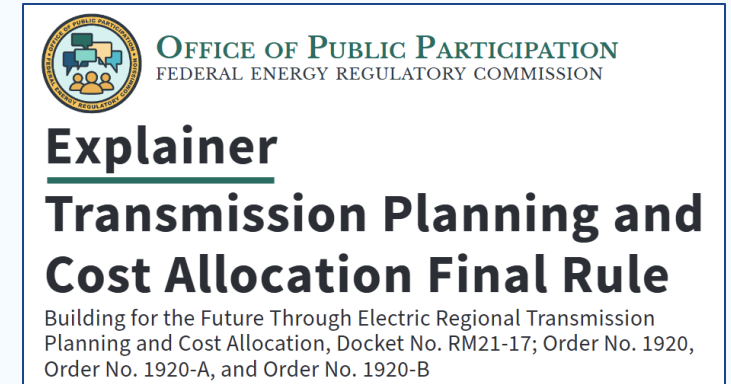
Paying

Need a standardized definition of transmission benefits. Also, chicken-and-the-egg problem for financing transmission.

Key issues:

- Fails to consider all the benefits of transmission or standardize
- Failure to pay from those who benefit (free rider problem)
- Unreasonable focus on precise quantification
- No real framework for interregional

FERC attempting to address issues with Order 1920



Congress/DOE has attempted to address with federal tools

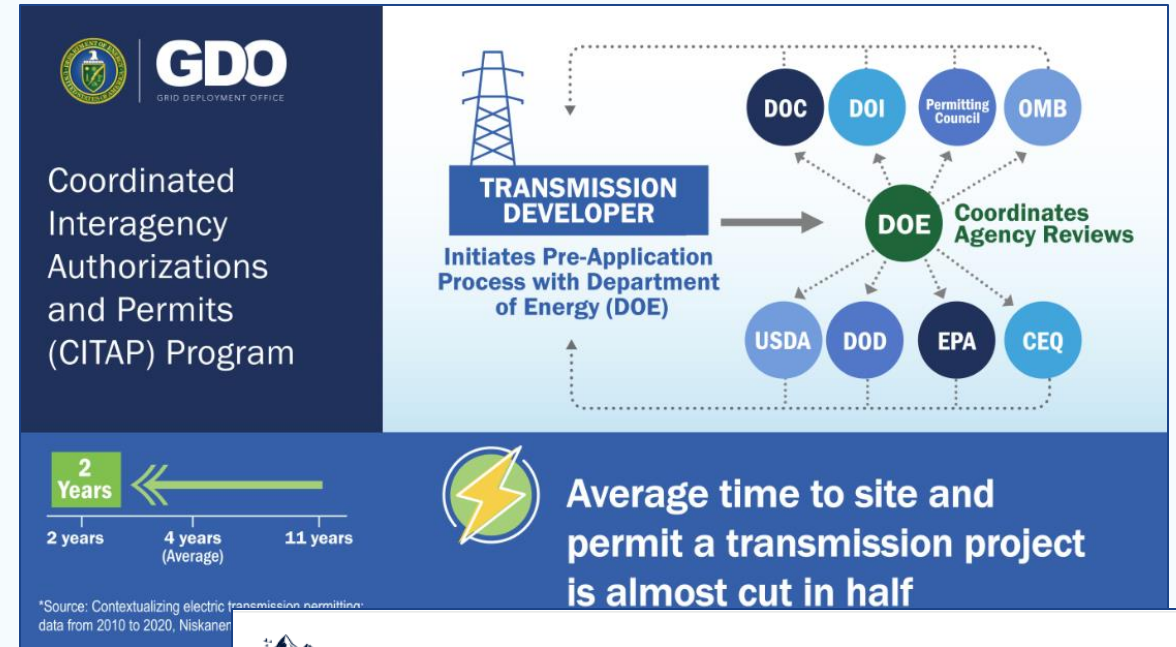
Permitting

Siting and permitting timelines slow down transmission development, especially where multiple entities must issue approvals.

Key issues:

- Federal, state, and local permits required
- No timelines and/or frequent delays
- Narrow view of benefits of transmission
- Failure to notify and engage landowners early in the process

DOE attempting to address with CITAP + support for state authorities



Congress taking up permitting reform (again)



HOUSE COMMITTEE ON NATURAL RESOURCES
CHAIRMAN BRUCE WESTERMAN

Westerman and Golden Introduce Bipartisan Permitting Reform Legislation

WASHINGTON, D.C., July 25, 2025 | [Committee Press Office](#) (202-225-2761)

[f](#) [t](#)

But first, get the most out of the existing grid

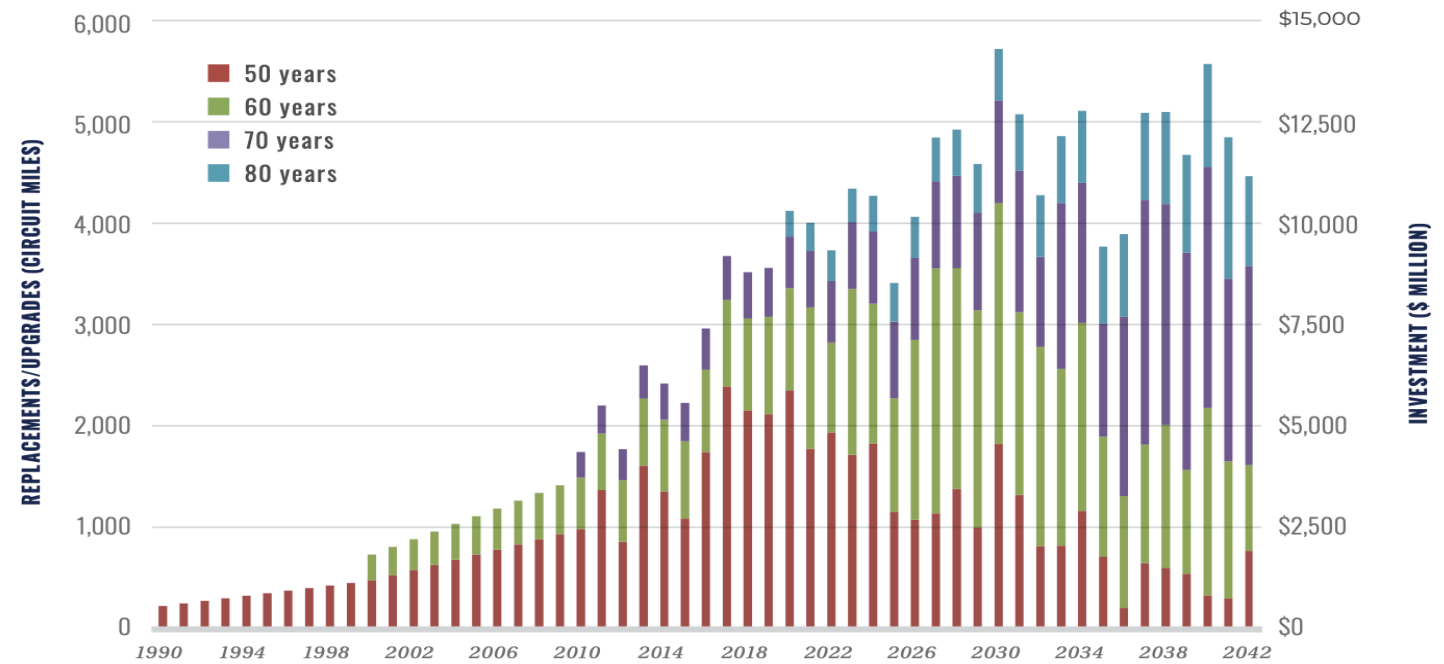
Grid Enhancing Technologies

- Power Flow Control
- Dynamic Line Ratings
- Topology Optimization

High Performance Conductors

- Carbon fiber / composite core conductors
- Superconductors

Huge opportunity to replace aging wires



Thank you!

Zach Zimmerman

Research and Policy Manager

zzimmerman@gridstrategiesllc.com

We offer research and advising on



Clean Energy
Integration

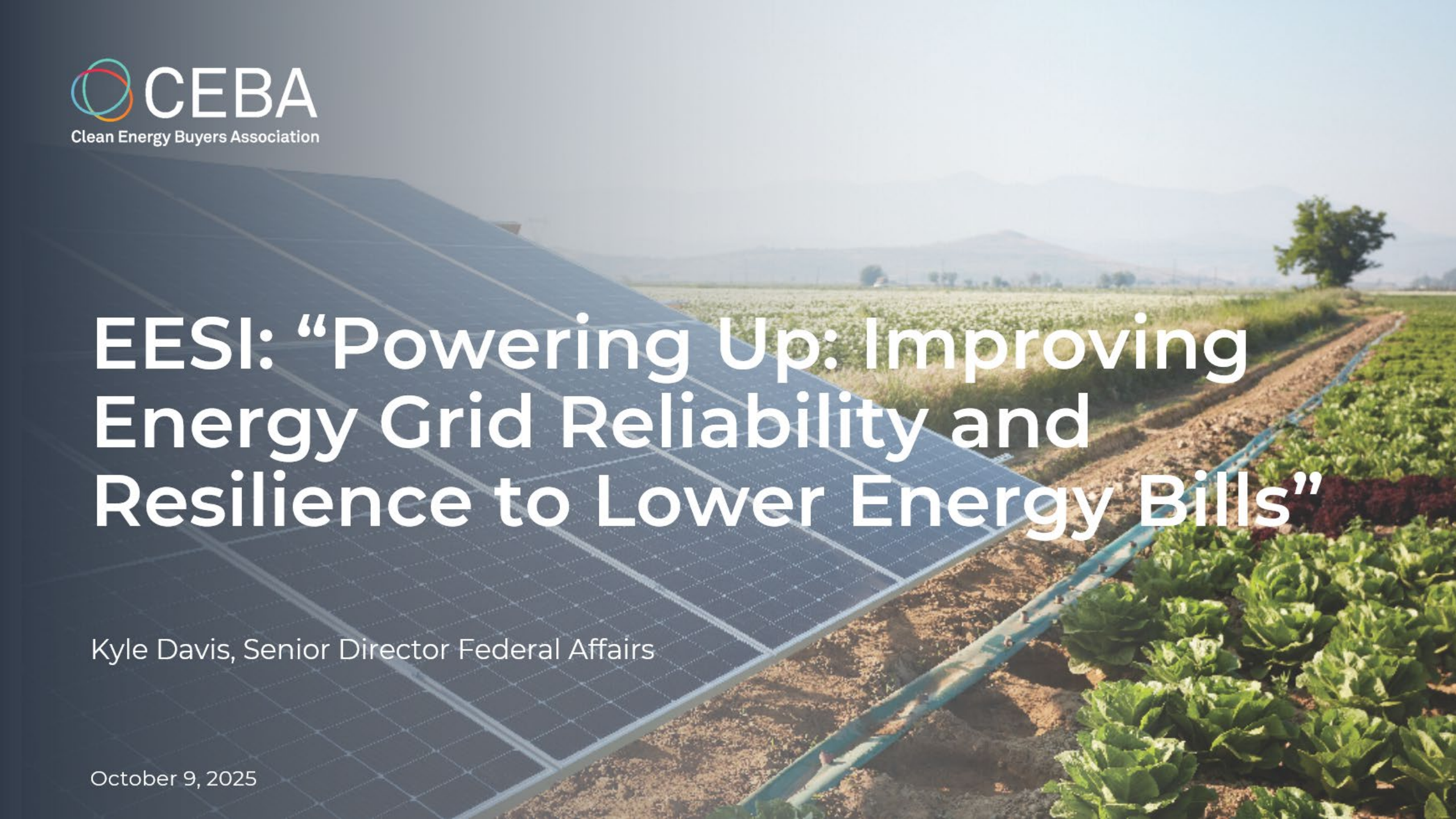


Business & Policy
Solutions



Regulatory
Engagement

Founded in 2017, Grid Strategies works on policy to enable decarbonization and an affordable, reliable electricity system.



EESI: “Powering Up: Improving Energy Grid Reliability and Resilience to Lower Energy Bills”

Kyle Davis, Senior Director Federal Affairs

October 9, 2025

Elevator Pitch

Who is CEBA?

“

CEBA is a business association that works with the **world's largest energy buyers** as well as energy and service providers **to advance low-cost, reliable, carbon-emissions free global electricity systems**. The organization is a trusted advisor providing objective, unbiased information and the preeminent voice on energy issues.

”

What Does CEBA Do?



Educates Stakeholders

Through market insights, collaboration, and hands-on procurement training, CEBA builds knowledge and capability across the clean energy community.



Ensures Clean Energy Access

Through smart policy engagement, CEBA ensures organizations maintain the freedom to choose the clean energy solutions that best meet their needs.



Enables Market Expansion

By advising on public policy and shaping industry standards, CEBA **accelerates clean energy purchasing and deployment.**

Types of Permitting Reform

“Infrastructure”

- Improve environmental reviews through the use of interactive, digital, and cloud-based platforms
- Limit scope and enact judicial reforms (i.e., standing and court review timelines) – National Environmental Policy Act (NEPA); Clean Water Act; National Historic Preservation Act
- Faster interconnection queues

“Transmission”

- Standardize the definition of transmission benefits
- Accelerate deployment of Advanced Transmission Technologies
- Increase interregional transfer capacity
- Mandate interregional transmission planning
- Establish dual pathways for transmission project approvals

“Project Siting”

- Wind/solar “ceasefire”
- Geothermal
- Hydropower
- Advanced nuclear

CEBA Signed ...



U.S. Chamber of Commerce



Connect with CEBA



On the web



On X



On LinkedIn



THANK YOU!





Pacific Gas and Electric Company (PG&E)

Patrick Hennigan, Director of Federal Affairs



Environmental and Energy Study Institute Briefing

Service Area

70,000

SQUARE MILES



Service Area Population

16 million
CALIFORNIANS

(That's 1 in 20 Americans!)

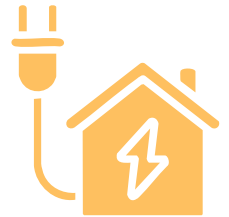


Electric Customers

APPROX.

5.8M

Customers



APPROX.

5.5M Electric
Meters

757 Substations



Distribution

(4kV, 12kV, 21kV, 34kV)

106,681

Circuit miles



Transmission

(60kV, 115kV, 230kV, 500kV)

18,466

Circuit miles





California's Energy Generation Mix

California has diverse forms of energy generation, including **natural gas, solar, nuclear, wind and energy storage.**

CALIFORNIA IS THE

4th

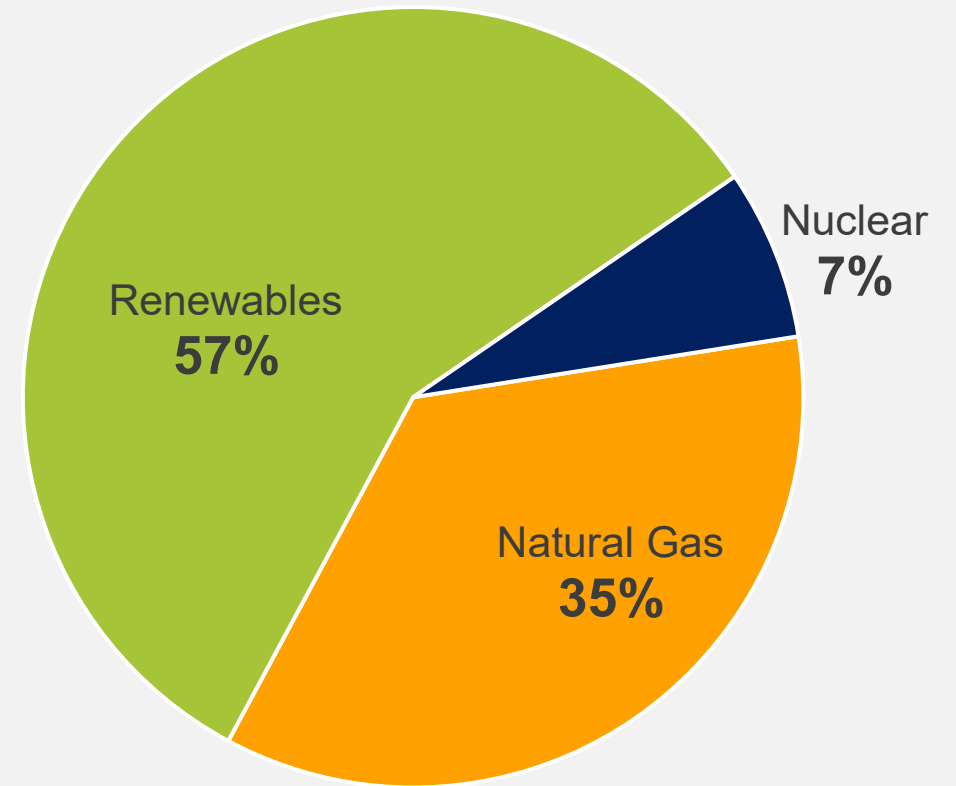
Largest electricity producer in the U.S.

2nd

Largest conventional hydroelectric power producer in the U.S.

Leading state with the most electric vehicles (EVs) and EV charging locations since 2016.

California's Energy Mix 2024



Source: US Energy Information Administration

Balancing Solar Supply with Peak Energy Demand

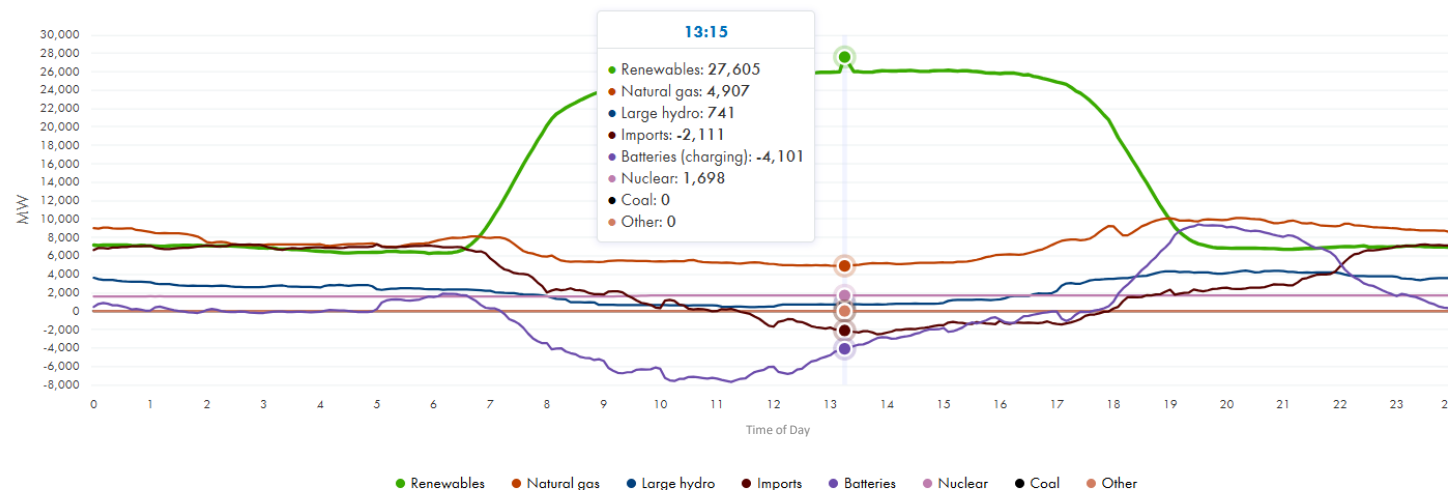


PG&E's duck curve illustrates the challenge of excess supply during midday and sharp peaks in the evening, when solar production declines just as residential consumption rises.

Supply trend

Power separated by resource, on a 5-minute average.

08/14/2025



During these peak periods, we often must rely on costly, fossil-based generation and export excess solar. Flexible demand technologies help balance supply.

Source: CAISO



The Future of Battery Storage



THIRD PARTY-OWNED
**Moss Landing
Power Plant:**

400MW

largest **lithium-ion**
battery energy storage
system in the world

**PG&E Moss Landing
Substation:**

182.5MW

TESLA MEGAPACK SYSTEM
largest **utility-owned**
battery energy system in
the world

MORE THAN

~1,200MW

battery energy storage projects

Currently under
PG&E contract = **>4GWh**

55,000

residential, business
and government energy
storage customers =
500MW

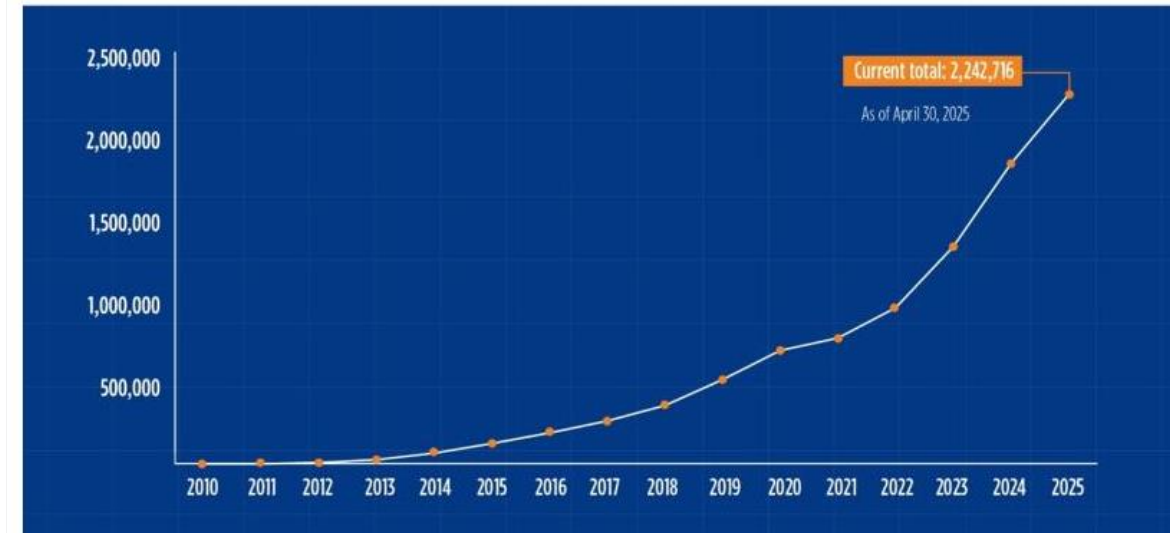


California's Electric Vehicle Future

The rapid acceleration of EV adoption not only represents one of PG&E's largest opportunities to lower emissions in the communities we serve but it is also projected to be the largest driver of load growth in our service area over the next 20 years.



Zero-Emission Vehicle Sales in California

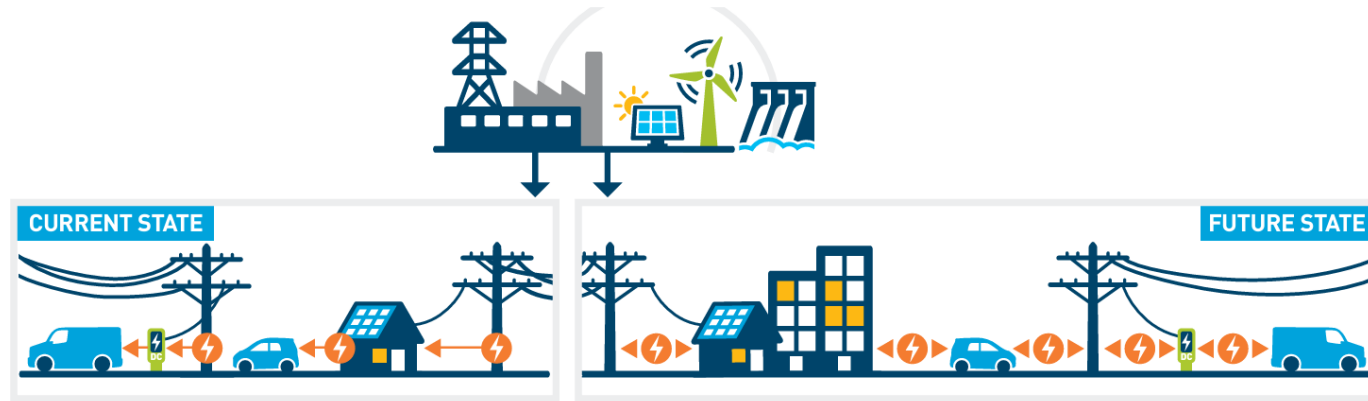


Source: California Energy Commission

740,000+ EVs in operation in PG&E's service area – about **1 in 8** of all EVs in the U.S. We expect to reach **~800,000 EVs by EOY**



EVs also offer the potential to balance our grid and add resiliency through bi-directional charging.



V1G / Uni-Directional Charging

Rates

Load that can be shifted via time differentiated rates to reduce or increase demand on the grid at certain times

Ex: [Residential EV TOU Rates](#), [Business EV Rate \(BEV\)](#), [Hourly Flex Pricing](#), [submetering](#)

Managed Charging

Load that can be actively shifted in response to grid conditions (Bulk system or distribution)

Ex: [Emergency Load Reduction Program \(ELRP\)](#) / [Virtual Power Plant \(VPP\)](#), EV Charge Manager

Bi-Directional Charging

Vehicle to Everything (V2X)

Power that can be exported from bidirectional electric vehicle systems (grid-tied installations and self-consumption)

Ex: [Vehicle to Home/Building & Vehicle to Grid \(V2G\)](#), [Vehicle to Microgrid](#)



Distributed Energy Resource Management System (DERMS)



In collaboration with Microsoft and Schneider Electric, PG&E's Flexible Service Connection is a bridge solution that helps customers with controllable loads to connect to the electric system without waiting for a service upgrade.

Our DERMS calculates the available energy supply one day in advance and automatically sends to customers so that they get the energy they need.

WITH FLEXIBLE SERVICE CONNECTION:

Customers Benefit

Customers experience quicker connections, more available energy and an improved utility partnership.

Capacity Increases

The distribution system unlocks available capacity, utilizes more of the grid and increases operational flexibility.

Energy Goals

Industry goals of timely energization, cost effectiveness and management of grid constraints are met.



The growth of AI and demand for data centers presents a challenge and opportunity for innovation.

Just as the energy system unlocks AI's potential, AI can transform the energy system by reducing risk, matching supply with demand, optimizing energy use, predicting and avoiding faults and serving as Distributed Energy Resources.

- New energy demand from data centers **allows PG&E to utilize more of our existing power infrastructure.** By **spreading the costs over more units of energy**, each customer's dollar can go further.
- We're working to serve **~10 GW** of new data center energy demand over the **next decade**, with **1.4 GW** currently in final design and **projected to come online between 2026 and 2030.**

Advanced Transmission Technology Investments

PG&E has invested in cost-effective, advanced technologies that **increase capacity on lines and decrease equipment fatigue** to help meet the challenge of growing transmission demand over the next 10-20 years.

- **Conductor Cushion Grips** – mitigate conductor fatigue due to vibrations from wind
- **High Temperature, Low Sag Conductor** – improves performance and cost savings
- Developing **Dynamic Line Rating (DLR) technologies** that aim to increase the thermal rating of transmission lines, improve capacity and efficiency and provide visibility into asset failures without compromising system reliability, asset health and safety.

Conductor Cushion Grips



High Temperature, Low Sag (HTLS) Conductor



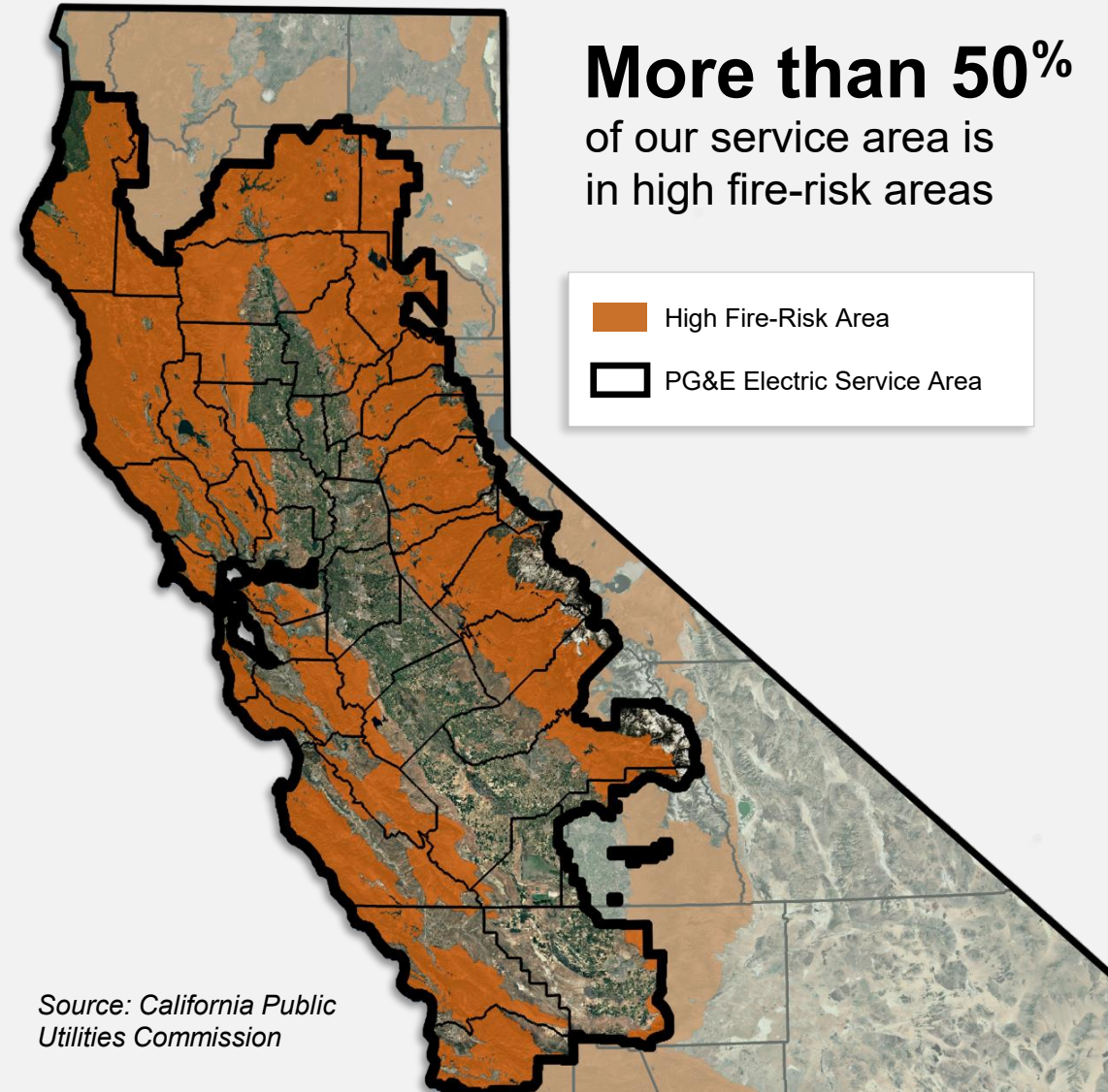


Responding to California's Wildfire Challenge

		PG&E SYSTEMWIDE	HIGH FIRE-RISK AREAS (HFRA)
Overhead	Electric customers served	5,800,000	532,000
	Distribution line miles	110,000	25,000
	Transmission line miles	19,000	5,000
Underground	Distribution line miles	29,000	4,000
	Transmission line miles	200	10

Values are approximate as of 4/1/2025.

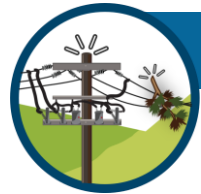
Public





Situational Awareness

- A** Advanced Weather Stations and HD Cameras



Operational Mitigations

- B** Dedicated Specialized Safety Teams
- C** Enhanced Powerline Safety Settings
- D** Public Safety Power Shutoffs



Resiliency Work

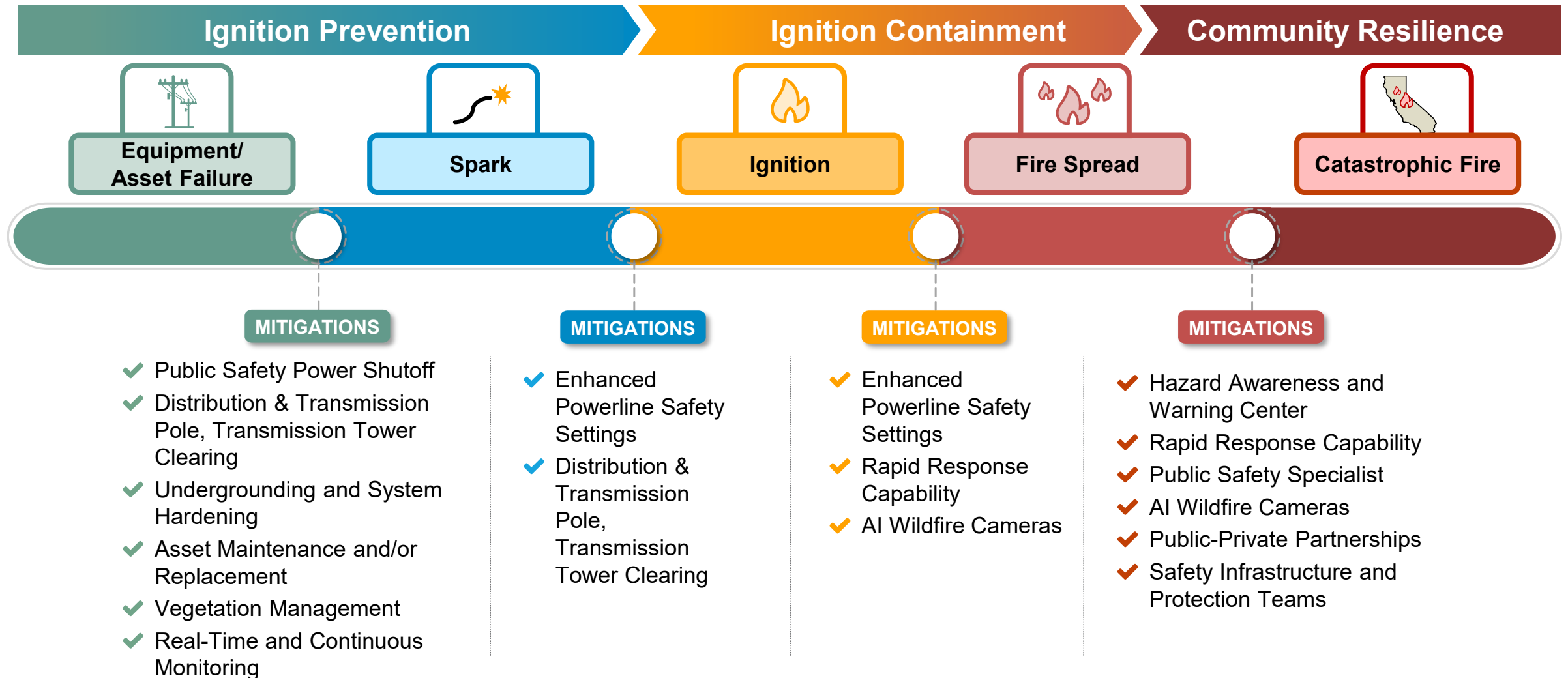
- E** Strengthened Poles and Powerlines
- F** Undergrounding
- G** Vegetation Management



For illustrative purposes only. Not to scale.

Reducing Exposure to Wildfire Risk

Wildfires from electrical equipment follow a common sequence. Interrupting that sequence is key.



PG&E's Aerial and Specialized Inspections (ASI) team utilizes cutting-edge drone and image technology to revolutionize the efficiency of system inspections. The ASI team creates precise data that informs standardized inspections to ensure safe, critical infrastructure.



INSPECTION METHOD:

Uncrewed Aircraft Systems (UAS)

Drones that produce high-resolution photos for review by experts.



INSPECTION METHOD:

Helicopters

Capture aerial photos as well as infrared and ultraviolet images.



Q&A



Thank You