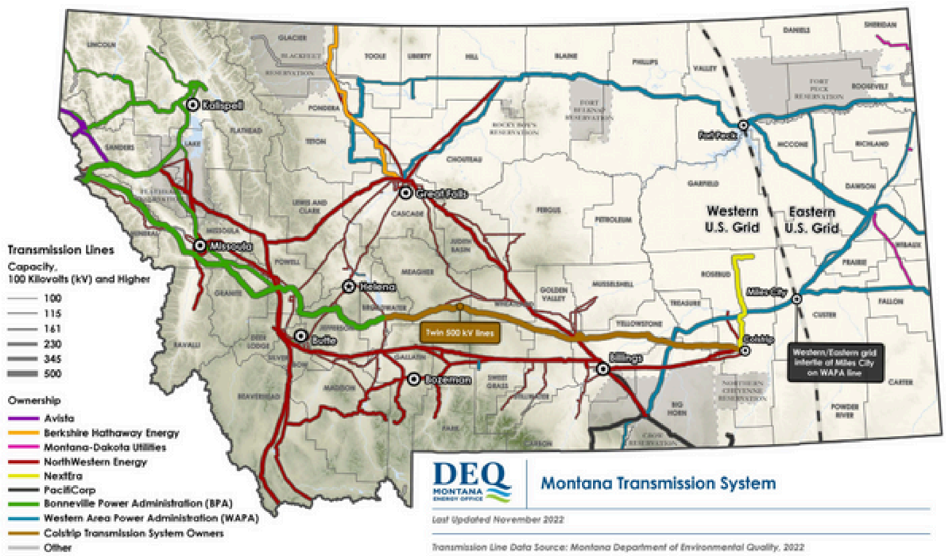
TRANSMISSION:

THE KEY TO CLEAN, RELIABLE, AND AFFORDABLE ELECTRICITY

A greater reliance on affordable clean energy will help curb rapidly escalating electricity rates in Montana, decrease harmful pollution, and ensure a reliable energy system. But there is an obstacle to realizing this cleaner, more affordable, and more reliable energy system – transmission. The existing electric transmission system was built decades ago, and like any old infrastructure, it cannot keep pace with modern energy demands and is in dire need of updating for the modern age.

Montana boasts the second-highest wind energy potential and fourth-highest solar energy potential in the US. This renewable energy, paired with storage, can reliably and affordably meet our energy needs. Unfortunately, electric transmission lines are currently the greatest bottleneck to this cleaner, more affordable electricity system. A well-connected and modern transmission system could move energy within and between states and regions, complementing regional weather patterns to achieve grid reliability by connecting energy where it is available to where it is needed. While developers race to build wind, solar, and energy storage resources, progress is impeded by an antiquated electric transmission system desperately needing upgrades and expansion.

MONTANA'S TRANSMISSION SYSTEM

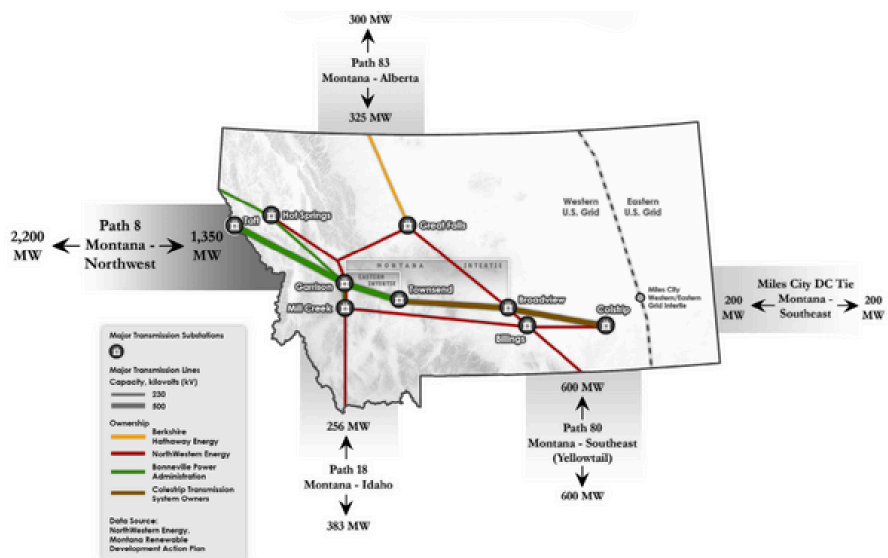


There are two types of power lines. Low-voltage "distribution" lines carry less electricity and are generally suspended by wooden poles to deliver power shorter distances directly to homes and businesses. Higher-voltage "transmission" lines are generally supported by tall metal towers and are used to move electricity long distances in our vastly interconnected electric grid.

Transmission lines come in a range of voltages, but this infrastructure is where the major bottleneck exists for moving power both throughout the state and between neighboring states

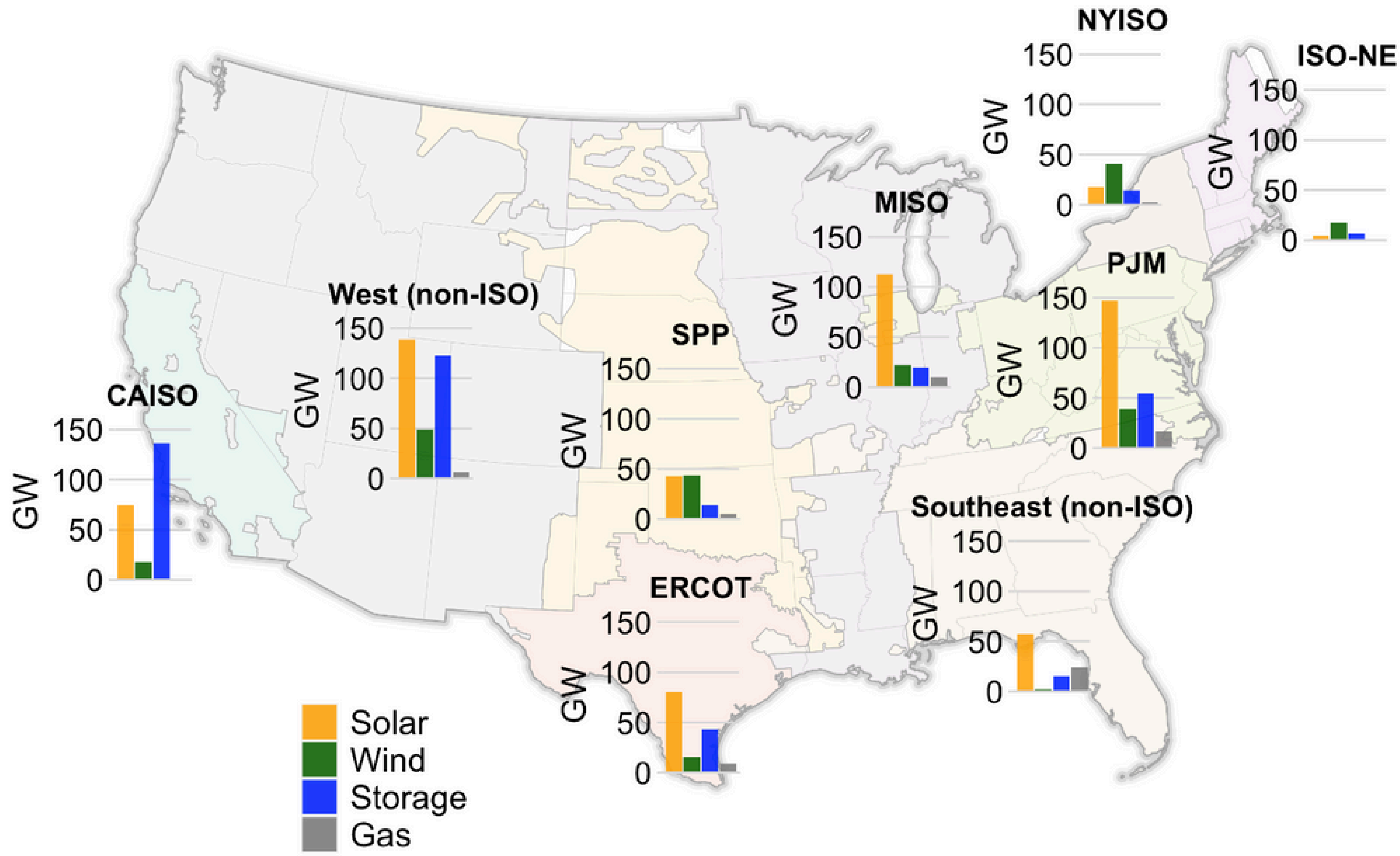
Montana's transmission system is split into two parts. The electric transmission system in the western two-thirds of the state carries electricity into and out of the Pacific Northwest. The eastern side of Montana's electric transmission system covers this less populous portion of the state and moves power to and from states east of Montana. These two transmission systems are part of national eastern and western grids and are not directly connected because the frequencies of the two systems are not synchronized.

Straddling these separate systems and with limited connectivity across state borders, Montana is severely limited in its abilities to move large amounts of power within the state and to trade power with utilities in other states.



Map of Montana's electric transmission lines by owner. Note the seam between the western and eastern grids.

INTERCONNECTION QUEUE



GW of energy projects sitting in interconnection queue at the end of 2023, according to study by Lawrence Berkeley National Laboratory.

New clean energy projects cannot be developed until they are able to connect to the transmission system (the grid). Montana has extensive untapped clean energy resources, while clean energy technologies have advanced dramatically over the past couple of decades, yet projects aren't being built because of the "interconnection queue."

The interconnection queue is the long list of projects that want to connect their projects to the grid as soon as there is room available on the system. A recent analysis found , "[m]ore than 12,400 MW of new generating resources have applied to [connect to NorthWestern Energy's transmission system]. 6,700 MW of these are under construction or in the final stages of the approval process … and have planned in-service dates before 2027." For reference, the Colstrip plant can produce up to 1,500 megawatts of electricity, of which NorthWestern only owns 222 MW of the plant.

IMMEDIATE SOLUTIONS:
RECONDUCTORING AND GRID ENHANCING TECHNOLOGIES (GETS)

The most immediate way to alleviate transmission issues, maintain reliability, and reduce pollution is to upgrade existing transmission infrastructure.

Addressing existing transmission bottlenecks using high-performance wires (known as reconductoring) can allow more electricity to pass through an existing line with little to no service interruption and a co-benefit of reduced wildfire risk.

Additionally, Grid Enhancing Technologies (GETs) can allow for better utilization of the entire transmission system.

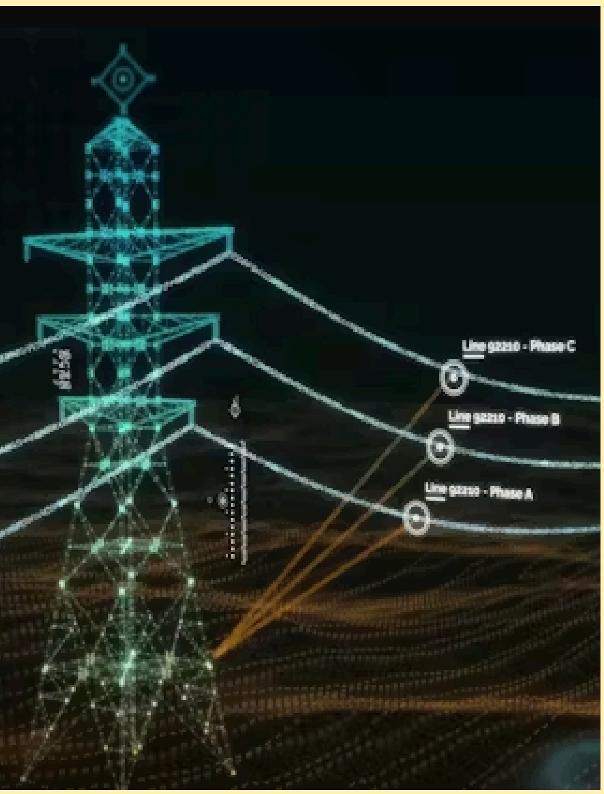
GETs are relatively cheap and easy to deploy, with the potential to increase the amount of electricity that can be carried on existing transmission lines by as much as 50%.

They include digital technologies and advanced communication devices that monitor transmission lines, transformers, and substations to use these assets more efficiently based on real-time grid conditions. These technologies have been used in Europe for years, but utilities in the U.S. are only beginning to adopt them.

GETs have recently drawn attention in numerous states, and Montana has the opportunity to join this movement. The three main GETs are Dynamic Line Ratings, Advanced Flow Power Control, and Topology Optimization.

GETS: ADVANCED FLOW POWER CONTROL

Today's electricity grid is more rudimentary than you might think, with grid power flow controlled by manually flipping switches at stations and substations throughout the system. This control can be achieved remotely and more strategically by installing digital control devices at substations between generators and electric loads so operators can optimize power flow, ease overburdened circuits, and safely move more power when possible.

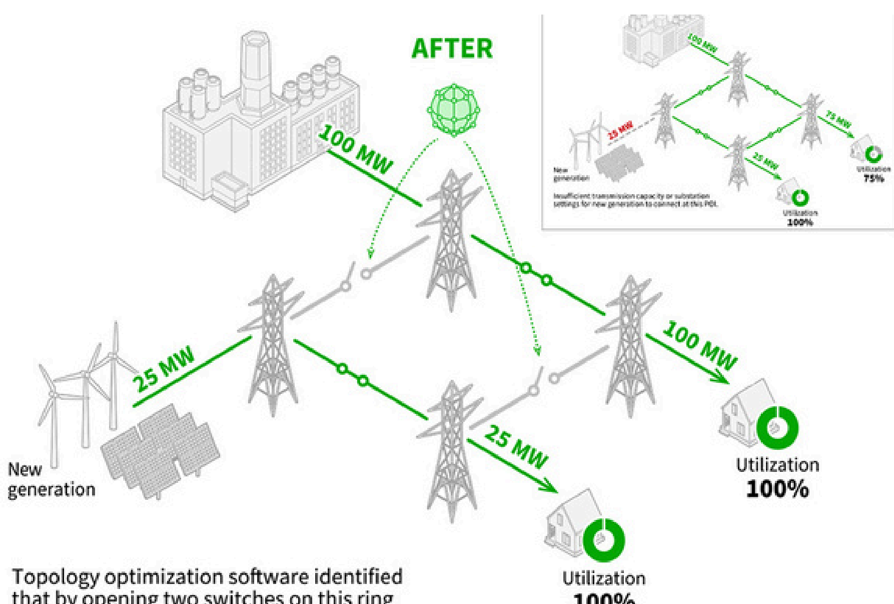


GETS: DYNAMIC LINE RATINGS

Currently, most transmission systems use high safety factors to limit electricity flow through the system based on the most extreme weather conditions the infrastructure might encounter seasonally or throughout its operating life. This avoids overloading the system with too much electricity in weather extremes where overheating may damage infrastructure or ignite wildfires from super-heated sagging lines. While essential in extreme conditions, these safety factors can dramatically reduce the electricity carried on a given line (i.e. lower its capacity). However, higher capacities can be achieved in most weather conditions if lines are monitored in real-time. Technology such as LiDAR imaging from transmission towers, in-line sensors, or data from nearby weather stations can monitor real-time line temperatures and forecast future temperatures so operators can maximize power flow throughout the system.

GETS: TOPOLOGY OPTIMIZATION

By incorporating a digitalized system-wide electricity grid model, specialized software can monitor and balance electricity flow throughout the system. Rather than a fallible human operator, this software mathematically determines and remotely programs optimal grid configurations in real time.



Topology optimization software identified that by opening two switches on this ring breaker configuration, power can safely flow to load.

POTENTIAL TRANSMISSION PROJECTS ON THE HORIZON

North Plains Connector

Planning to create a much larger connection between the Western and Eastern grids in Montana and North Dakota, the North Plains Connector is currently seeking permitting and regulatory approval for construction spanning 2028 to 2032. In the Summer 2024, the Department of Energy awarded two grants worth $747 million towards developing this project and supporting communities and infrastructure along and downstream of its route.

Garrison to Ashe

In February 2024, the Bonneville Power Administration (BPA) proposed a new transmission line between Garrison, Montana and Ashe, Washington. If built, this line would greatly relieve transmission congestion between Montana and west coast markets.

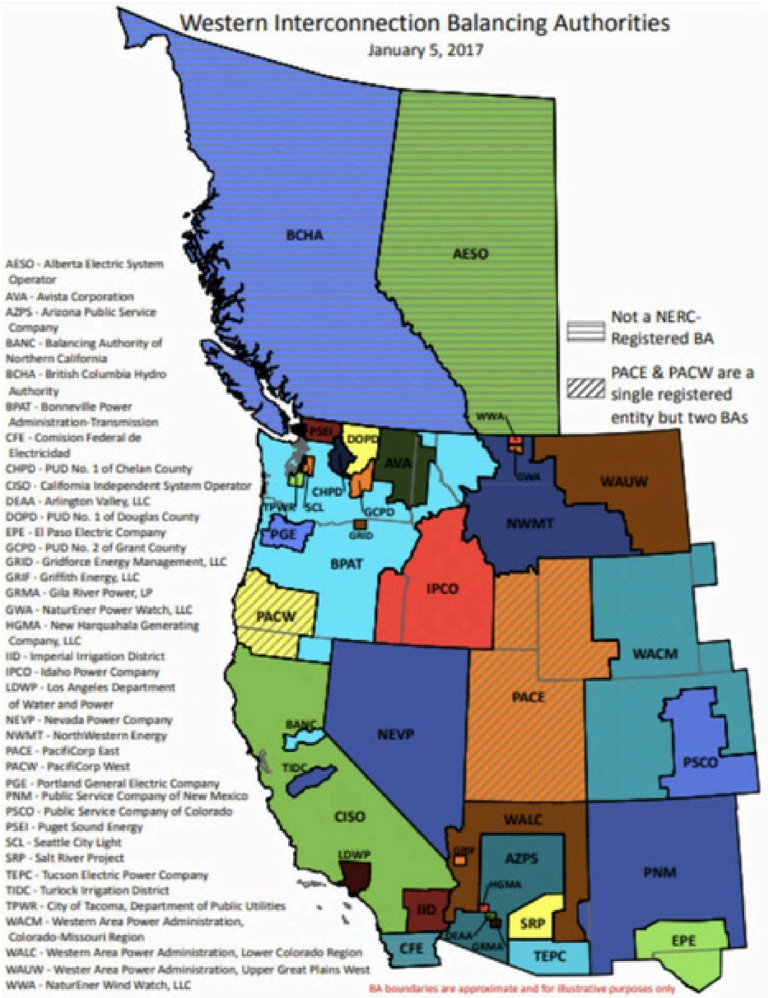
Montana-to-Washington (M2W) Upgrade

BPA and transmission developers have been negotiating a major upgrade to an existing transmission line that spans from Montana to Washington. This project is past its design stage and an environmental impact statement (EIS) is in development.

Mountain States Transmission Intertie (MSTI)

This project was proposed, studied, and later abandoned by NorthWestern Energy in the 2010's. The intent was to build a new, high-voltage transmission line from Townsend, Montana to Midpoint, Idaho, which would have connected Montana to tremendous and complementing electric resources to the south and helped to alleviate price spikes experienced in extreme weather events such as the January 2024 cold weather event. Unfortunately, this project was a case study for what can go wrong if communities and stakeholders are not adequately engaged from the start. Transmission experts still hold out hope for this line down the road.

REGIONAL & NATIONAL TRANSMISSION STUDIES AND PLANNING EFFORTS



Coordinated regional and inter-regional transmission planning is essential to ensure that the electric grid of the future is optimally developed to ensure reliability and affordability and deploy the tremendous backlog of clean energy projects as quickly as possible. These planning efforts are particularly important in the western United States where transmission lines are owned and operated by a patchwork of utilities and related entities. Here are a handful of these efforts:

- Western Transmission Expansion Coalition (WestTEC)
  - “A West-wide effort to develop an actionable transmission study to support the needs of the future energy grid.”
- Connected West Transmission Plan
  - “A plan to reliably and cost-effectively help serve the growing energy needs in the West.”
- Federal Energy Regulatory Commission (FERC) Order 1920 (Building off Order 1000)
  - “Ensuring a reliable grid by requiring the nation’s transmission providers to plan for the transmission we know we will need in the future.”
- Department of Energy (DOE) National Transmission Planning Study
  - “To understand the transformation needed to ensure the U.S. electric transmission system continues to reliably serve the nation’s electricity customers as the power sector evolves and transitions to cleaner resources, the U.S. Department of Energy's Grid Deployment Office led the multiyear National Transmission Planning Study (NTP Study) in partnership with the National Renewable Energy Laboratory (NREL) and the Pacific Northwest National Laboratory (PNNL).”
- Rocky Mountain Institute (RMI) States in Sync western transmission study
  - “We show that Western regional transmission expansion is a win-win economic opportunity for all Western states — Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming — and that the most expansive planning leads to the greatest benefits.”

READ MORE:

https://www.nrel.gov/docs/fy24osti/87843.pdf

https://www.lazard.com/media/xemfey0k/lazards-lcoeplus-june-2024-_vf.pdf

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https://watt-transmission.org/what-are-grid-enhancing-technologies/#:~:text=The%20technology%20could%20enhance%20the,Development%20and%20Innovation%20at%20NYPA.

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https://montanafreepress.org/2024/08/06/montana-lands-700-million-for-north-plains-connector-transmission-project/

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https://www.westernpowerpool.org/about/programs/western-transmission-expansion-coalition https://connectedwest.org/

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https://rmi.org/insight/states-in-sync-the-western-win-win-transmission-opportunity/