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U.S. Electric Grid Overview
Transmission is the backbone of U.S. electric grid
The U.S. is split into three electric grids

- **250 GW**
- **700 GW**
- **140 GW**

Interconnections:
- **1,320 MW**
- **800 MW**
Most (but not all) of U.S. grid is in regional markets
Challenges / Opportunities
Transmission needed to meet ambitious climate goals

- The US set ambitious climate goals with the Inflation Reduction Act (IRA).
- ...but its potential emissions reductions can only be met with significant transmission expansion.
  - If transmission buildout continues at its current rate, we will lose ~80% of the IRA’s potential emissions reductions.
- “To unlock the full emissions reduction potential of the IRA, the pace of transmission expansion must more than double the rate over the last decade....”
  - This allows rapid addition of clean electricity generation (e.g. from wind and solar).

NO TRANSMISSION → NO TRANSITION

Transmission is the “best” battery

“...Transmission is more cost effective than storage at increasing the renewable energy penetration....”
– MISO’s Renewable Integration Impact Assessment (RIIA)
Interconnection queue backlogged across U.S.

• Over 10,000 projects representing 1,350 MW of generation and 680 GW of storage are actively seeking interconnection

• Majority (1,260 GW) is zero carbon

• Average time projects spend in queues has increased markedly:
  • <2 years in 2008
  • 3 years in 2015
  • 5 years in 2022

New Transmission Links Can Save Consumers Money

“The latest market data show that the potential savings of new electric transmission was higher last year [in 2022] than at any point in the last decade.”

–Lawrence Berkeley National Lab

Resiliency During Extreme Weather Events

As the risk of extreme weather events increases with a changing climate, interregional transmission corridors can help mitigate the risk of widespread outages. Extreme weather scarcity events are large scale, but regional in nature, rarely overlapping across regions at the same time or intensity.

When West had extreme heat in August 2020, Midwest was cooler than average.

Mean Temperature Departures from Average
August 15-21 2020
Average Period: 1981-2010

When Midwest had extreme cold in February 2021 (Winter Storm Uri), West was mild.
Big transmission projects have taken too long to get built.

Solutions
Transmission is in the news

Electricity prices surged 14.3% in 2022, double overall inflation: US report

To build a clean grid, we need to build a lot more transmission. Approval of the TransWest Express line is a big deal and represents great progress—but we need even more lines, and we need them fast. This one took 16 years to approve, and we won’t reach net zero if we can’t build more transmission more quickly.

Why the U.S. Electric Grid Isn’t Ready for the Energy Transition

To start with, there is no single U.S. electric grid.

By Nada Rooch and Brad Plumer

We Desperately Need a New Power Grid. Here’s How to Make It Happen.

By Attracta Mooney

The Big Read: Electric power

Gridlock: how a lack of power lines will delay the age of renewables

A backlog of wind and solar projects is waiting to connect to infrastructure built for another era, threatening net zero plans.
Some federal action, but more is needed

• IIJA / Bipartisan Infrastructure Law (2021)
  o Strengthened FERC’s backstop siting authority
  o Transmission Facilitation Program ($2.5B DOE fund)

• Inflation Reduction Act (2022)
  o New sources of funding
    – Transmission Facility Financing
    – Funding for Loan Program Office
    – Grants for Interstate Electricity Lines
  o Transmission tax credit stripped from IRA at last minute 😞

• Debt ceiling bill (2023)
  o Established (weak) NEPA deadlines
  o Another transmission study...
HVDC technology can enforce – and improve – AC grid

HVDC is the preferred technology for moving large amounts of power across long distances—with higher efficiency and smaller footprint than equivalent power AC.

- Lower cost, due to higher efficiency than AC
- Fast, precise bi-directional power flow control
  - Can be strategically used as a firewall to prevent disturbances on one AC grid from spreading to another AC grid
  - Mitigates power imbalances on AC grid
  - Can honor commercial power contracts by controlling flow
    - In contrast, AC’s power flows per physical laws.
- Increases grid reliability and resiliency
  - “Black start” capability can jumpstart a grid after a blackout
  - Provides many ancillary services for reliability
  - Dynamic voltage response to grid disturbances in milliseconds
    - Allows increased integration of renewable resources by reducing low-frequency and voltage oscillations
Grid United is co-developer of Southline & North Plains.