Electricity Transmission and Railroads: A Synergy of Needs and Right-of-Ways

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THE Brattle GROUP
Significant transmission investment needs will be driven by decarbonizing the economy:

- Increased electricity loads from decarbonizing transportation, industry, and home heating
  - Replacing fossil fuel with electricity produced by non-emitting resources
  - Electricity needs are projected to increase by 50-100%
- Need to move low-cost renewable generation resources to load centers
  - Lowest-cost wind in Great Plains (TX to ND)
  - Lowest-cost solar in Southwest (TX-NM-AZ-NV-CA)
  - Population center loads located on coasts
- Need transmission system to diversify renewable generation variability
  - Span regions larger than typical weather systems
  - Interconnect regions with different renewable generation types (wind, solar, geothermal, hydro)
Renewable and Clean-Energy Policies

30 States + DC have a Renewable Portfolio Standard, 5 states have a Clean Energy Standard (8 states have renewable portfolio goals, 5 states have clean energy goals)

Source: https://www.dsireusa.org/resources/detailed-summary-maps/
Electrification of Passenger Transport

Recent studies predict EV growth to continue rapidly over the next decade

- Low-end of estimates suggest 10 million EVs in the U.S. by 2030; about 10x the number of EVs in the U.S. today
- High-end of estimates are at 35 million EVs by 2030; about 30x over today’s level

Projected EV Sales in the U.S. (2020 – 2030)

Source and Notes: EPRI, PEV Market Projection Assumptions: June 2018 Update, June 2018. (EPRI Low forecast not shown because its 2030 forecast is below the levels already obtained.); BNEF, Electric Vehicle Outlook, 2019; IEI/EEI, Electric Vehicle Sales Forecast and the Charging Infrastructure Required through 2030, November 2018; Wood Mackenzie, Electric car forecast to 2040, accessed May 2020; EIA, Annual Energy Outlook: Light-duty vehicle sales by technology type and Census Division: United States, 2020; BCG.
Regional and Long-Haul Fleet Electrification

Electric MDV and HDV trucks are also being developed and purchased to reduce transportation emissions

- Other vehicle types are likely to be beachhead markets for fleets
- Walmart recently increased its order of Tesla Semis to 130 trucks

Long-haul trucks will require DCFC capacity on major corridors

Fleet Electrification Commercialization Pathways

High Priority Regions for Electric Truck Deployments
Renewable Generation and Storage are being Developed across the U.S.

While states have greatly expanded their clean energy goals to achieve significant decarbonization goals over the next decades, renewable development is occurring everywhere.

- Renewables and storage make up 90% of capacity being developed across the entire country.

*Not all of this capacity will ultimately be built.*
Brattle study found that electrification will drive $3 billion/year of incremental transmission investment over the next decade

- Increases to $7 billion/year between 2030 and 2050
- High electrification sensitivity finds $7 billion/year in near term; $25 billion/year from 2030 to 2050

**US Transmission Investment Driven by Economy-wide Electrification**

Transmission investment needs to meet electrification demand largest in North Central, Southeast, and Northeast regions

- Base case studied suggests regional needs of $30-$50 billion by 2050 in these three regions
- High electrification case find investment needs of $100-$125 billion by 2050 in those regions

Diversifying Low-Cost Clean Energy
Proposed Transmission Projects Indicate High-value Paths

Existing inter-regional transmission proposals seek to capture available value; proposed projects indicate where developers believe the highest-value paths are.

- Few of these projects will get built unless permitting challenges are overcome and cost allocation through inter-regional planning process becomes possible.
Railroad Right-of-Ways Almost Perfectly Cover the Needed Transmission Corridors

National Network of Class I Railroads

Takeaways

- The electricity sector is going through a rapid transformation with substantial growth in renewable resource development due to declining costs and clean energy policies
  - Personal and commercial transportation modes are starting to see accelerating electrification, increasing electricity demand
  - Electrification of transport, industry, and home heating will require an additional $7 billion to $25 billion per year of cost-effective transmission upgrades to access and integrate the renewable resources needed for electrification
- The railroad corridors provide a great opportunity for siting new transmission facilities that otherwise may not get built
- Synergies between transmission investments and railroad electrifications need to be explored more fully
Additional Reading

Well-Planned Electric Transmission Saves Customer Costs:
Improved Transmission Planning is Key to the Transition to a Carbon-Constrained Future

Link: https://bit.ly/3dnKrxe

Toward More Effective Transmission Planning:
Addressing the Costs and Risks of an Insufficiently Flexible Electricity Grid

Link: https://bit.ly/2GU4h7w

The Benefits of Electric Transmission: Identifying and Analyzing the Value of Investments

July 2013

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Link: https://bit.ly/3jS0PsB

Link: https://bit.ly/34slZai
Additional Reading


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Johannes (Hannes) Pfeifenberger is an economist with a background in power engineering and over 20 years of experience in the areas of public utility economics and finance. He has published widely, assisted clients and stakeholder groups in the formulation of business and regulatory strategy, and submitted expert testimony to the U.S. Congress, courts, state and federal regulatory agencies, and in arbitration proceedings.

Hannes has extensive experience in the economic analyses of wholesale power markets and transmission systems. His recent experience includes the analysis of transmission benefits, reviews of RTO capacity market and resource adequacy designs, testimony in contract disputes, cost allocation, and rate design. He has performed market assessments, market design reviews, asset valuations, and cost-benefit studies for investor-owned utilities, independent system operators, transmission companies, regulatory agencies, public power companies, and generators across North America.

Hannes received an M.A. in Economics and Finance from Brandeis University and a B.S. and M.S. ("Dipl. Ing.") in Power Engineering and Energy Economics from the University of Technology in Vienna, Austria.
Mr. John Michael Hagerty has 10 years of experience in the electric power sector, including analyzing the scale and impacts of electrification on the electric power system and developing a cost-effectiveness framework for beneficial electrification. Michael’s experience with clients related to deep decarbonization and electrification includes analyzing the scale of transportation and heating electrification necessary to achieve 80% GHG reduction goals in New England for the Coalition for Community Solar Access, the nationwide transmission needs to support broad electrification through 2050 for the WIRES Group, and the benefits and costs of electric city buses and indoor agriculture for EPRI. He also has experience in transmission benefit cost analysis and wholesale market design.

Mr. Hagerty received his M.S. in Technology and Policy from the Massachusetts Institute of Technology and his B.S. in Chemical Engineering from the University of Notre Dame. Prior to joining Brattle, Mr. Hagerty was a research assistant at the MIT Energy Initiative, an oil refinery process engineer at Honeywell, and a research chemist at GE Global Research.
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