

Transmission Expansion to Support Efficient Decarbonization of the U.S. Electricity Sector

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MIT

June 21, 2022

(recorded for June 28, 2022)



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Transmission Expansion to Support Decarbonization of Electricity Generation

- Goal is to meet deep decarbonization targets for the electricity sector (e.g. “net zero” by 2050) efficiently
- Deep decarbonization of the electricity sector between now and 2050 will rely heavily on solar, wind, and storage to replace fossil generation (see MIT CEEPR Working Paper 2022-003 or IEA Path to Zero study)
- Best wind and solar resource locations are different from the locations of existing generating fleet and often further from demand (load) centers
 - Offshore is closer to load centers but there is no existing transmission network
- Wind and solar are “intermittent” and output depends on sometimes rapid variations in wind speeds and direction and solar irradiance patterns rather than traditional economic dispatch
 - Economic and Reliability implications
- Larger wholesale market areas facilitate cost-saving by diversifying intermittent supply and variable demand consistent with reliability criteria
- Electricity demand will grow as other sectors (e.g. transportation, buildings) are electrified
- **Implications:** Significant investment in additional transmission infrastructure is needed to access the best wind and solar resources, to expand wholesale market areas for cost saving diversification, and to meet reliability criteria in the face of dominance of intermittent wind and solar generation
 - The existing transmission infrastructure is aging too
- Major transmission projects can take 7-10 years or more (including never) from concept to completion
- Efficient expansion and reinforcement of the transmission infrastructure faces several barriers that should be addressed

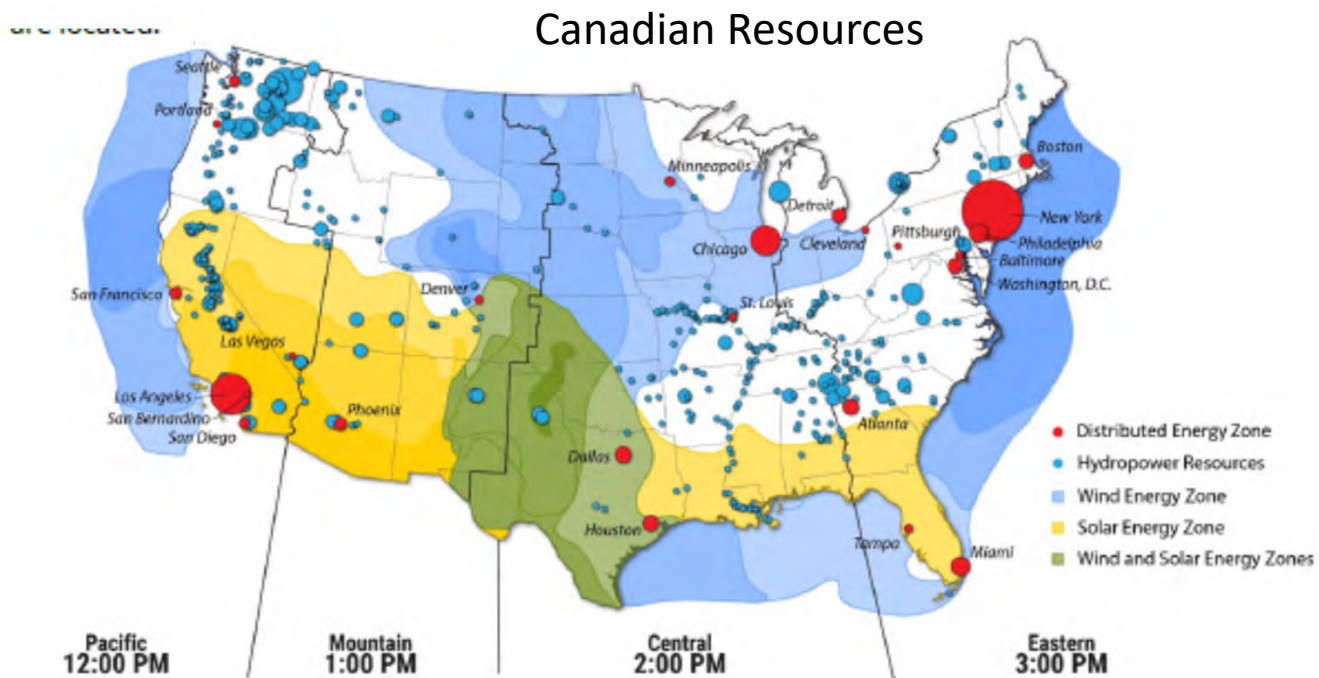
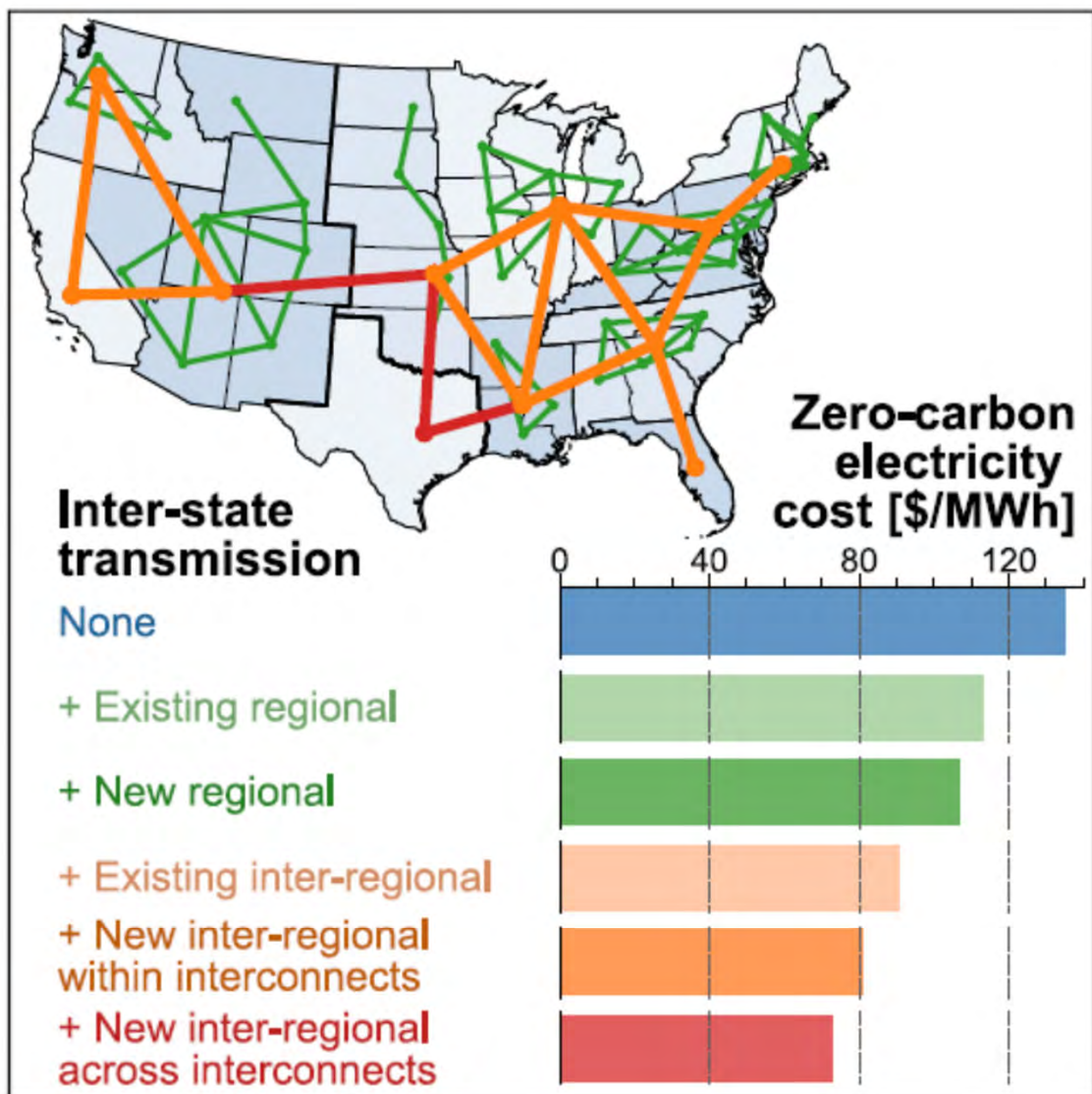


Figure 6. Renewable energy zones that must be connected to efficiently transition to a clean energy economy.

https://www.vibrantcleanenergy.com/wp-content/uploads/2020/11/ESIG_VCE_11112020.pdf



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HIGHLIGHTS

US electricity demand can be met with currently available zero-carbon technologies

Inter-regional coordination and transmission construction significantly reduce cost

Nuclear, if available, plays a smaller role than renewables at central cost projections

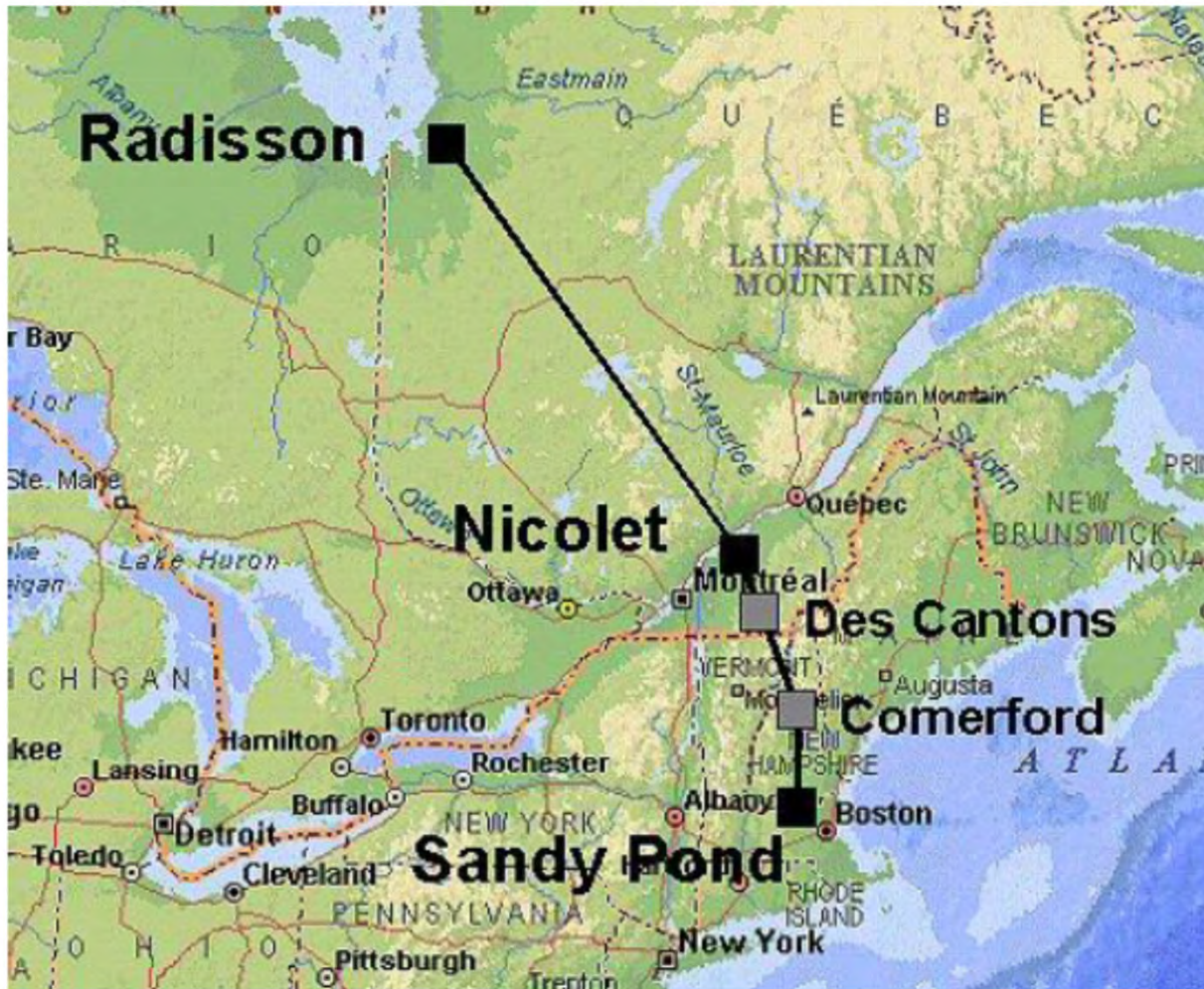
Nationally planned decarbonization is more efficient than state or regional approaches

Please cite this article in press as: Brown and Botterud, The Value of Inter-Regional Coordination and Transmission in Decarbonizing the US Electricity System, Joule (2020), <https://doi.org/10.1016/j.joule.2020.11.013>

Major Intra- and Interregional Projects Were Completed in the Past

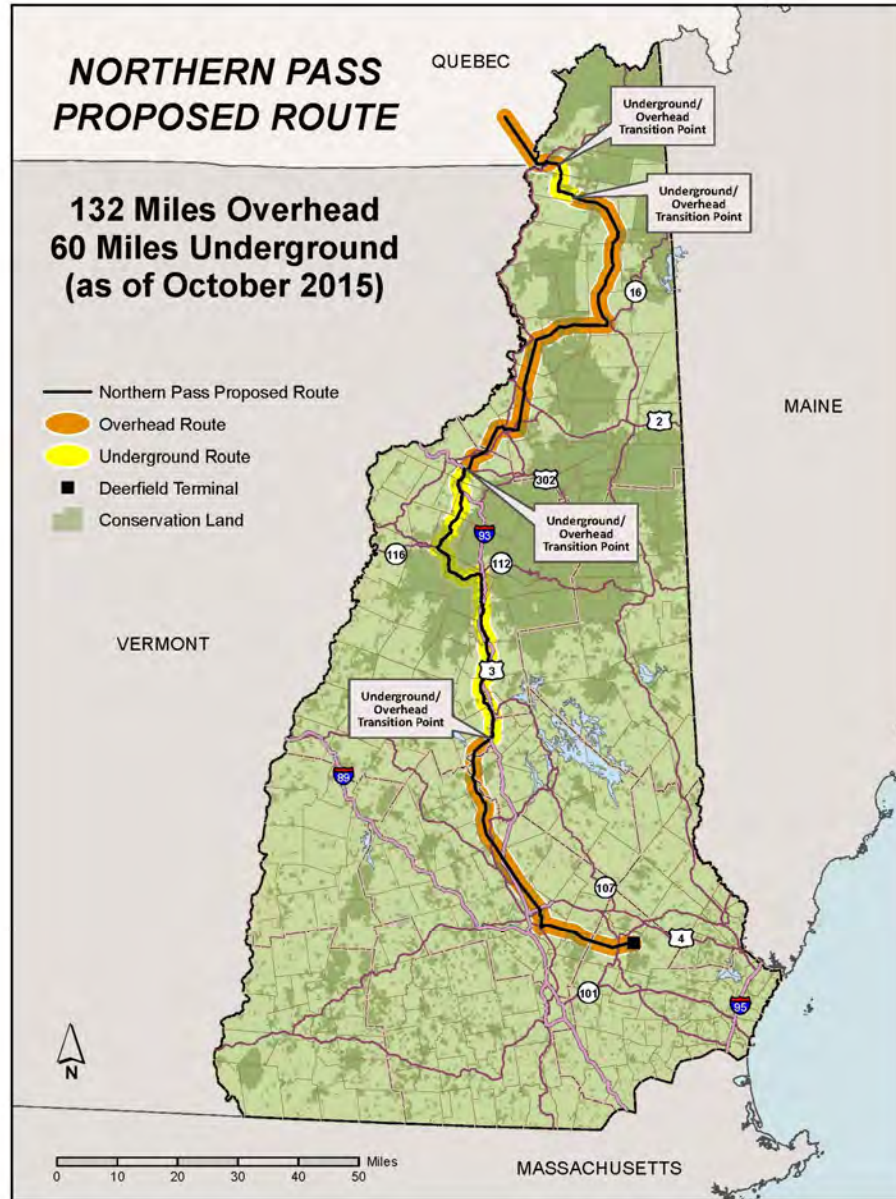
- Never Easy
- Historically primarily developed along with a generating source (s) by regulated VI utilities
- CREZ projects (Texas) relied on focused planning, competitive bidding and COS regulation
- It has gotten more challenging as the need has grown

New England-Hydro-Quebec HVDC Phase II



Permitting Started 1984
Energized 1990

Several More Recent Major Projects Have
Faced Barriers Causing Delays and
Cancellations



<https://forestsociety.org/map-northern-pass-proposed-route>

Who Does Transmission Planning and Investment in the U.S.?

- In the U.S., transmission planning is primarily the responsibility of the ISOs or the remaining VI utilities.
- FERC Order 1000 added additional planning regions to cover non-ISO areas but it does not appear that they do much coordinated planning.
 - Added interregional planning obligations
 - Added competitive procurement obligations
 - Created “public policy” transmission projects
- Each ISO comes up with a Regional Transmission Expansion Plan (RTEP -- - names vary) that designates “needed” transmission investments
- It then designates incumbent or (rarely) new transmission owners (TO) to build the facilities identified needed
 - FERC regulates cost allocation and prices for transmission services
- Merchant projects are permitted but are now typically outside the RTEP process
 - Currently treated as “generators” with focus on interconnection since primarily HVDC
 - Long queues for interconnection studies and facility expansion (recent FERC NOPR)
 - Few such projects completed yet in the U.S.

Barriers to Efficient Expansion in the U.S.

- It's not just NIMBY
- Absence of comprehensive national decarbonization policies and objectives
 - Absence of national carbon price consistent with decarbonization targets
 - Some states, utilities, and companies have developed their own decarbonization targets
 - Various de facto market interventions to meet targets
- Deficiencies in transmission planning
 - Geographic scope is too small
 - Failure to incorporate all benefits and costs in the transmission planning process, especially including decarbonization in transmission planning objective functions
 - Reliability projects
 - Market efficiency projects
 - Public policy projects and other workarounds
 - Project by project rather than portfolio analysis
 - No comprehensive incorporation of decarbonization objectives
 - Single state ISOs with state decarbonization targets are doing much better (NY, CA)
 - Project-by-project evaluation rather than evaluating portfolio of projects
 - Planning time horizons are too short (chicken and egg problems) (recent FERC NOPR on long-term transmission planning)
 - Failure to take uncertainty into account --- scenario analysis
 - Project specific rather than portfolio analysis
 - Merchant-like projects are developed outside of the planning process

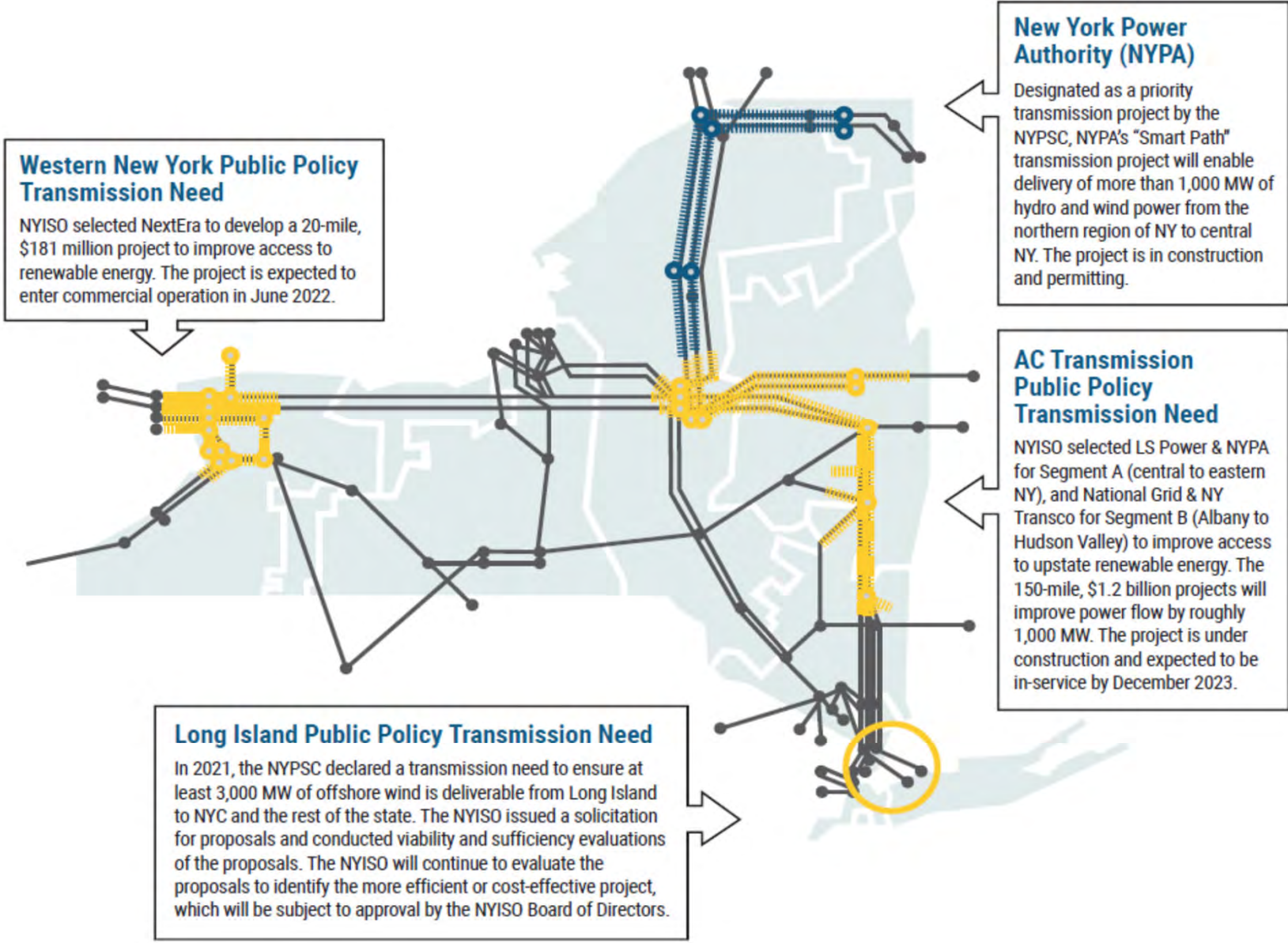
Barriers to Efficient Expansion in the U.S.

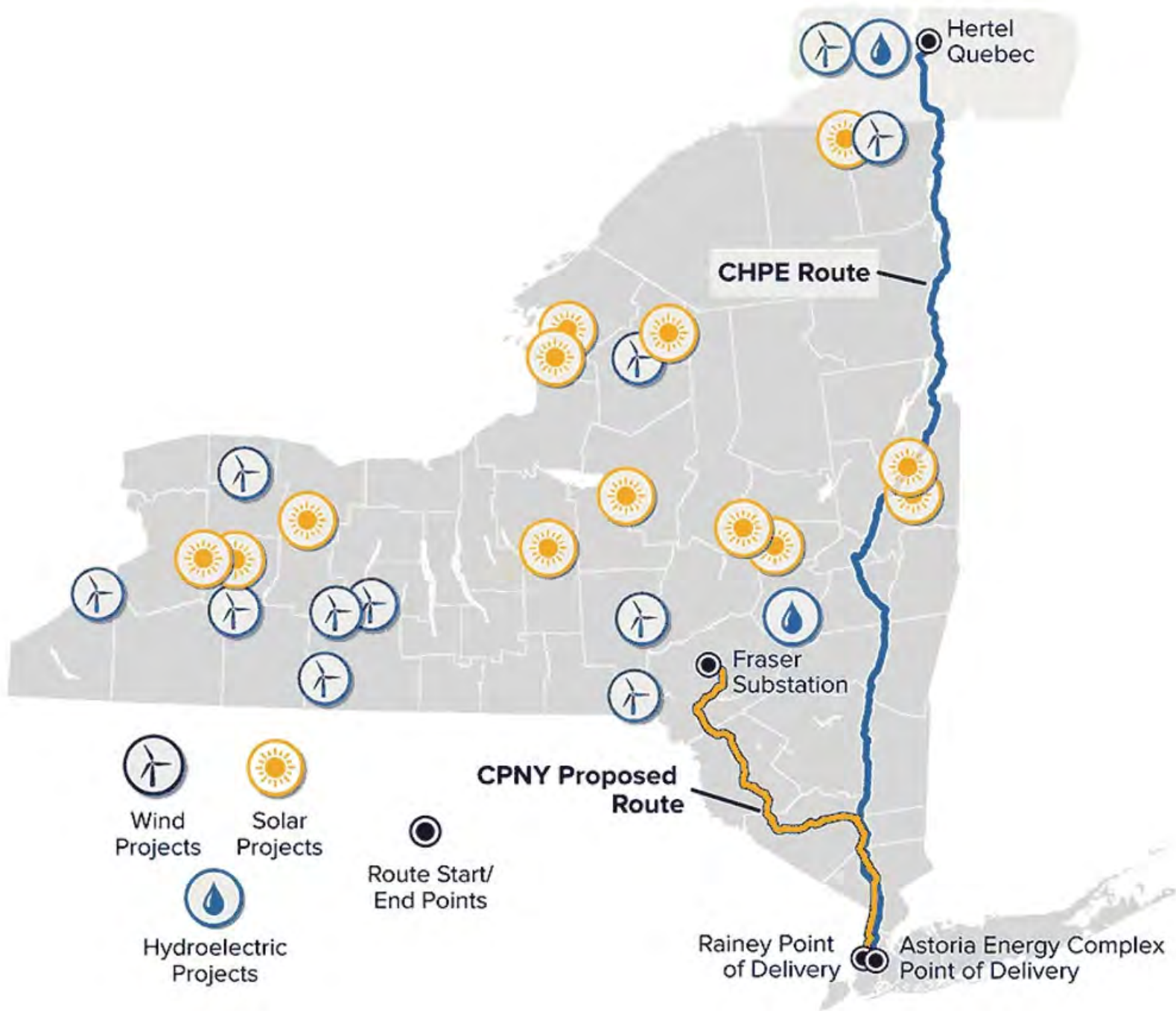
- Financing and cost allocation
 - Cost-of-service regulated projects
 - Competitive procurement for regulated projects with cost/performance commitments and incentives
 - Merchant projects – outside regional planning process
 - Now adopting natural gas pipeline development and regulatory process
 - Who pays? Especially for projects to support decarbonization
- Complex and time consuming local, state, and federal permitting processes and interest group opposition to projects (NIMBY)

New York Approach

- Focus on resource and transmission in New York largely in isolation from surrounding states
- The major state agencies work together with the NY ISO to meet NY climate policy goals
- Transmission planning
 - Use FERC authorized public policy transmission category to select projects to be included in the ISO's long-term transmission plan
 - Include accessing carbon free electricity to meet NY targets in the objective function
 - Rely on competitive procurement with performance commitments for "regulated" projects
 - Encourage merchant projects to NYC with indexed RECs and competitive procurement
 - Developers rely on "anchor tenant" energy supply contracts along with the merchant transmission projects
- Cost allocation largely to LSEs based on proportionate load
- But ISONE and PJM are not part of the planning process

Figure 19: New Transmission Projects in New York State





Reducing the Barriers

- Permitting and Stakeholder Opposition (NIMBY)
 - Get more out of the existing system
 - Re-examine reliability criteria
 - Real-time line ratings
 - Upgrade facilities on existing rights of way
 - Use other existing rights of way (railroads, canals, highways)
 - Incorporate underground and underwater routes
 - Consolidate permitting processes
 - Local, state, federal
 - Use independent mediators
 - Share the benefits along the route
 - Curb any anti-competitive practices (competitive entry deterrence)