Canadian Analysis

Report Summary

Recognizing that Canadian systems play a crucial role in the interconnected North American bulk power system, NERC conducted transfer capability and energy margin analyses to evaluate the reliability benefits of enhancing cross-provincial and cross-border transmission. This analysis complements NERC's Interregional Transfer Capability Study (ITCS) published last year.

Why This Study is Important

Previous NERC assessments identified the need for more transmission, as well as a strategically planned resource mix, to address the ongoing electrification of the economy including the growing transportation sector, industrial loads, and data centers. More frequent extreme weather events further compound the challenge. These factors emphasize the importance of adequate and informed planning at a broad interregional level to support future grid reliability. A common approach, consistent assumptions, and coordinated results, are key elements of the Canadian Analysis.

Key Findings

1. Canadian systems were found to be increasingly vulnerable during extreme weather due to anticipated load increases and the changing resource mix. Transmission limitations, and the potential for energy inadequacy, were identified in all 12 weather years studied. Enhancing transmission interfaces could reduce the likelihood of energy deficits during extreme conditions.

2. Reliability risks are highly dependent on regional weather conditions. The import capability that could be beneficial during extreme conditions varied significantly across the country. An additional 12-14 GW of transfer capability may be an effective vehicle to strengthen energy adequacy under extreme conditions:
   - Québec faces energy deficits due to projected demand growth, especially during extreme winter conditions, with a maximum deficiency of 10 GW.
   - Nova Scotia faces shortages in all the weather years studied. Expansion of transfer capability with New Brunswick would address these deficits.
   - Energy deficits were also identified in Alberta, Saskatchewan, Ontario, and New Brunswick. There are multiple options that could address these deficiencies via additional transfer capability, including expansion of cross-Interconnection capability, new connections, and upgrades to existing interfaces.

3. More recent industry forecasts reflected in *2024 Long-Term Reliability Assessment* data generally result in considerable improvement, particularly in Ontario and Québec, as resource projections catch up to demand forecasts. Ongoing studies will capture the impacts of future forecast changes.

4. Weather-related outages were not found to be a major contributor to deficiency events, as Canadian systems are generally designed to handle extreme cold conditions. However, high winter peak loads can still challenge the available energy supply.

5. Some identified transmission additions could be addressed by projects already in the planning, permitting, or construction phases. Likewise, existing system capability to switch resources or load between provinces, which was not accounted for in this study, may help reduce the identified shortfalls.

6. The importance of maintaining sufficient generating resources underpins the study's assumptions. Higher-than-expected retirements (without replacement capacity) would lead to increased energy deficiencies and potentially more transfer capability additions if surplus energy is available from neighbors.

7. A broad set of solutions should be considered, including transmission, local resources, demand-side, and storage. A diverse and flexible approach allows tailored solutions specific to each province's vulnerabilities, risk tolerance, economics, and policies.

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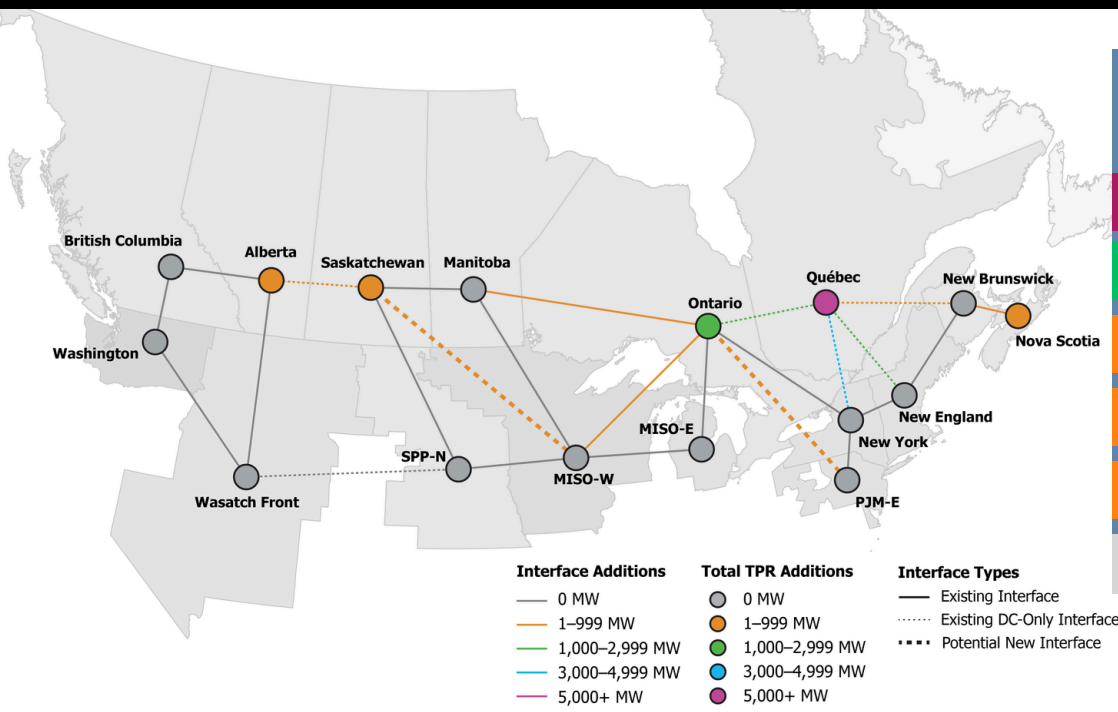
Transfer capability additions are based on 2033 resource mix and other study assumptions



Strengthening Reliability Through Additional Transfer Capability

- Québec — 10,300 MW
- Ontario — 1,600 MW
- Alberta — 600 MW
- Nova Scotia — 500 MW
- Saskatchewan — 500 MW

TOTAL — 13,500 MW

Shaping the Future: Insights for Canadian Industry Leaders and Policymakers

- With more than 31 transmission lines connecting the United States and Canada, the North American grid is designed to operate on a continent-wide basis, allowing for the flow of power across geographic and national boundaries.
- There is an increasing need to regularly conduct wide-area energy assessments to evaluate changing resource projections and potential weather impacts.
- System planning should holistically evaluate transmission and resources over a wide area to assess whether resources in neighboring areas are available during times of need.
- Barriers to transmission development, including siting and permitting challenges, may present risk.
- Tailored solutions specific to each province's vulnerabilities, risk tolerance, economics, and policies, may include transmission, resources, and/or demand-side enhancements.

Canadian Analysis – In Scope

- A common modeling approach to study the North American grid independently and transparently.
- Evaluation of the impact of extreme weather events on hourly energy adequacy using the calculated current transfer capability and 10-year resource and load futures.
- Identifying of additional transfer capability that could address energy deficits when surplus is available in neighboring regions.
- Extensive consultation and collaboration with Canadian utility experts from provincial utilities.
- Reliability improvement as the sole consideration.

Canadian Analysis – Out of Scope

- Economic, siting, policy, or environmental impacts.
- Alternative modeling approaches – these results may differ from other analyses.
- Quantified impacts of planned projects.
- Endorsement of specific projects, as additional planning by industry would be necessary to determine project feasibility.
- Recent changes to load forecasts, renewable targets, or retirement announcements.

Canadian Analysis

Video

Canadian Analysis

Interactive Data Portal

Canadian Analysis

Resources