Transmission Expansion Planning: A Canadian Point of View

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Challenges (from 2008 AWEA event)

- Can we build enough transmission to accommodate expected growth in wind (1000 MW/year).
  - Cost allocation.
  - Transmission siting/permitting issues.
  - Interconnection queue logjams.
  - Uncertainty in reliability impacts of high penetration level of renewables; evolving grid codes.
  - Uncertainty in value of stronger east-west transmission grid.

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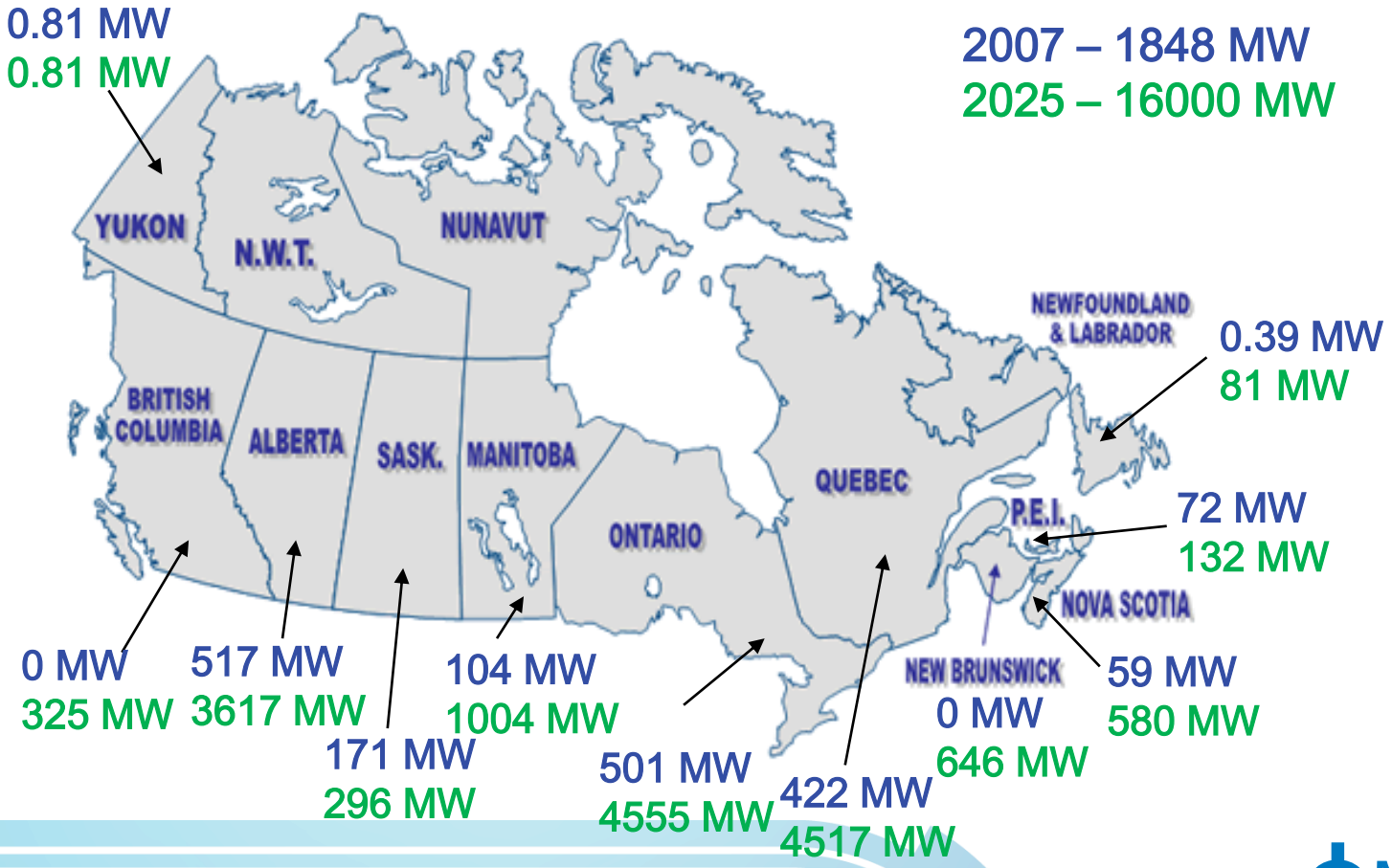
Expected Regional Growth to 2025



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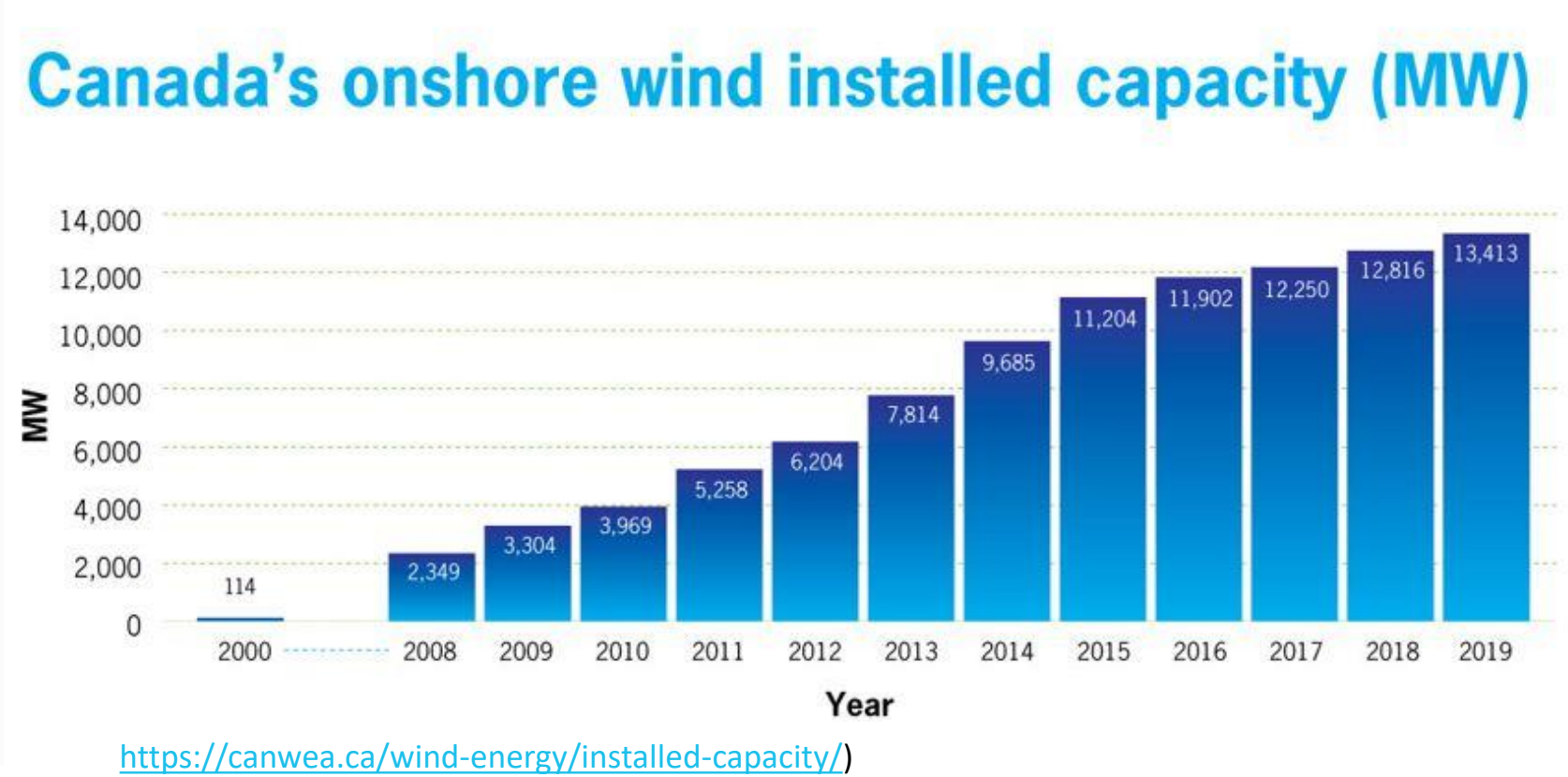
Increase in Canadian Wind



https://canwea.ca/wind-energy/installed-capacity/)

Wind supplies about 5% of demand today; expected to supply about 10% by 2040.

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History (2008-2020)

- Cost allocation– generally resolved for local generator connections via tariff reforms; still an issue for inter-regional transmission. In the Maritimes, cost allocation among four provinces unresolved.
- Transmission siting/permitting – transmission included with wind as part of project scope for permits.
- Interconnection queue log jams – Improved via tariff reforms (group studies), RFPs, etc.
- Operational concerns/Grid Codes – Pan Canadian wind study (PCWIS) demonstrates 30% can be managed. NERC variable gen TF, Canadian grid code study result in improved grid codes.
- E-W grid – PCWIS and RECSI shows value of improved transmission interconnections.

Current Challenges

NERC 2019 LTRA Key Finding #4: Transmission Planning and Infrastructure Development need to keep pace with an increasing amount of Utility scale wind and solar resources.

- 15,000 miles of new transmission are expected over next 6 years. 35-40,000 miles has typically been projected to be needed over 10 year planning horizon. The vast majority of current projects in the LTRA are short lines (10-100 miles).

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Is NERC right?

Province	Transmission Planned	Resources
BC	150 miles; majority needed for new hydro	100 MW solar, 200 MW wind, 600 MW hydro
Alberta	1100 miles	900 MW solar, 4400 MW wind, Tier 3 – 8000 MW
Saskatchewan	200 miles	80 MW solar, 800 MW wind
Manitoba	250 miles; new US and SK interconnections (900 mile Bipole III – 2018)	630 MW hydro
Ontario	325 miles; majority in NW Ontario for reliability	50 MW solar, 460 MW wind
Quebec	400 miles; majority for new hydro	1000 MW solar PV; 54 MW wind, 245 MW hydro
Maritimes	40 miles; 100 mi DC link in 2017; 700 mi NFLD DC link in 2020	3 MW solar, 80 MW wind; 824 MW Muskrat Falls

For Canada – NERC is partly right

- Total transmission planned for Canada over next decade is 2500 miles (exc Nfld); US is 12500 miles. Considering a 10:1 US-Canada load ratio, Canada is developing about twice the US.
- Alberta has the most uncertainty, primarily because of its market structure. The majority of other provinces are vertically integrated and have long term resource plans.

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Why has Transmission Development slowed?

- Lower load growth; Partly caused by increased focus on demand side management including addition of distributed generation in some areas.
- Large scale projects are expensive and take 10+ years to develop. Distances between provinces, major load centers and remote communities are high. These projects are prone to many risks (escalating costs, lower priced alternatives, market price risk).
- Some uncertainty about high penetration levels of inverter-based generation.

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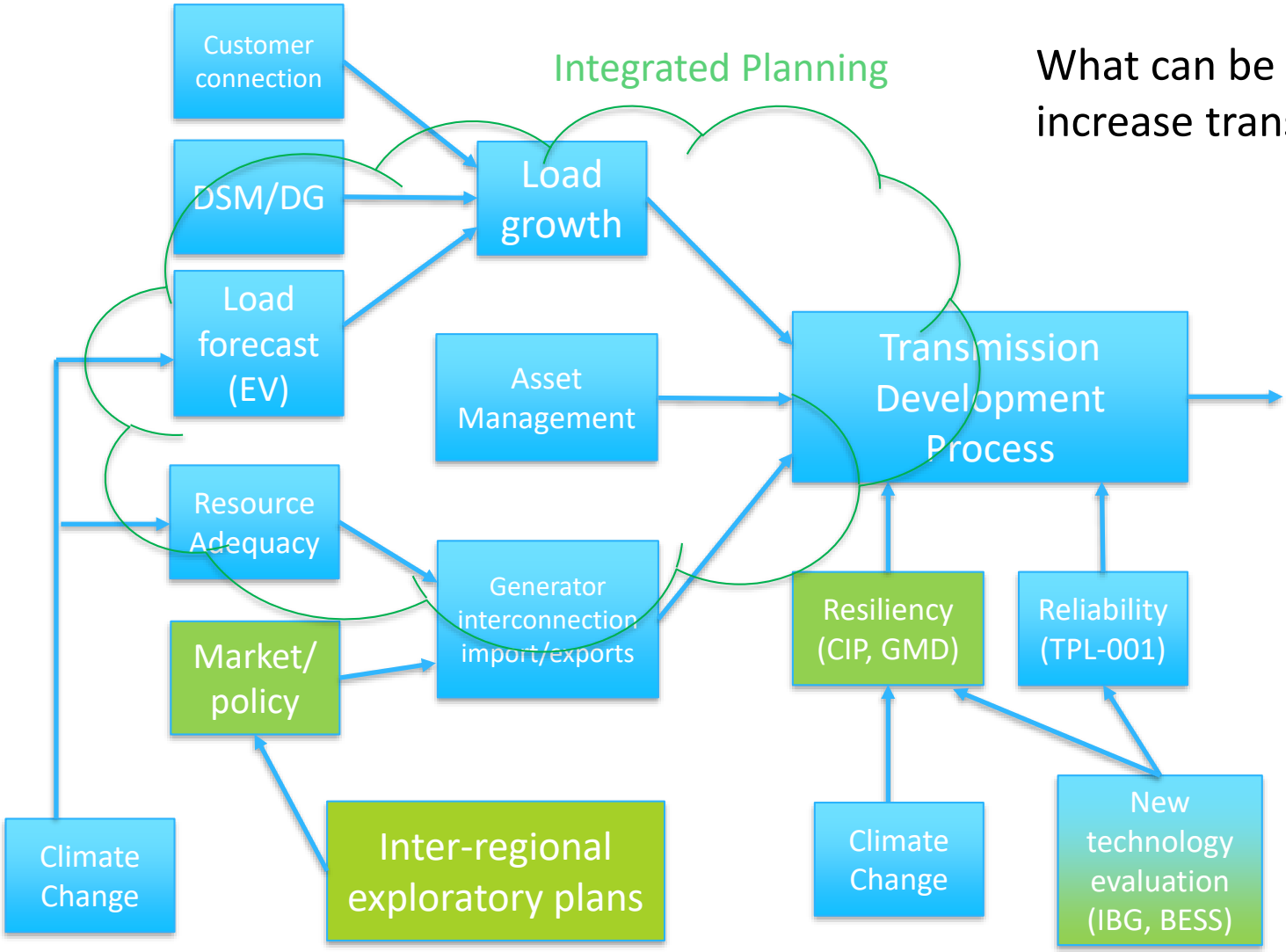
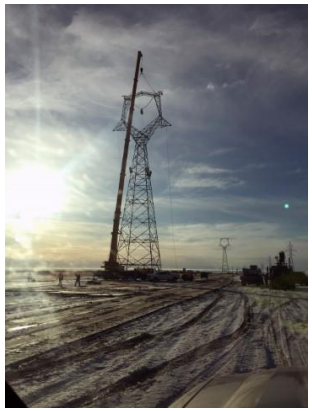


What can be done to increase transmission?



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Markets/Policy

- Market price – Improve certainty in long term market products and value. Many studies (eg. NARIS) are noting benefits of interconnections to improve sharing of ancillary services and reserves.
- Transmission incentive/Climate policies – In Canada, Federal funding is available for regional transmission projects that reduce GHG and accelerate coal retirement. Long term certainty in climate policies is an important factor.

Resilience

- Resiliency – ability to limit the extent, severity, and duration of system degradation following an extreme event.
- May provide incentives for new transmission development, which may provide opportunities for generator connections.
- Continue to study effects of high penetration levels of IBG to ensure grid resilience and reliability.

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Promote Integrated and Inter-regional Planning

- Improved communication between G-T-D may help remove some uncertainty and may lead to more efficient plans.
- Inter-regional planning may uncover interesting regional projects. Limited success to date.
  - Eg. MB-SK 1000 MW Exploratory (https://www.oasis.oati.com/woa/docs/MHEB/MHEBdocs/MH-SPC_Inter_Regional_Planning_Exploratory_Study(11.01.2019).pdf)

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Streamline Development Process

- Remove uncertainty in cost allocation in multi-regional projects.
- Business arrangements can be complex and variable between regions: Utility owned, partnerships, merchant transmission. Improve business practices.
- Separate environmental and need processes exist across jurisdictions. Harmonize if possible.

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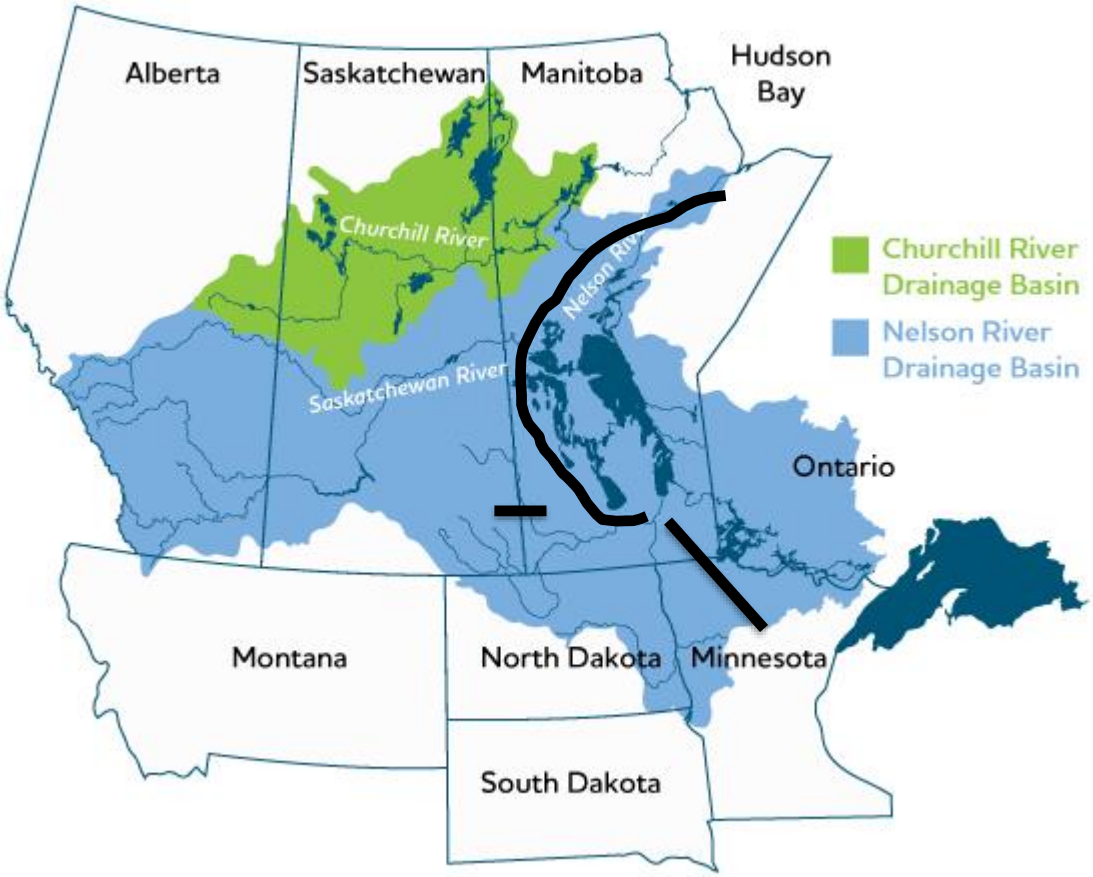

- **Bipole III – ISD 2018**
- 500 kV dc; 2000 MW – 870 mi
- Need – resilience (improve 1/20 year risk of loss of corridor due to wind/ice/tornado); Provides Gen outlet for hydro, spare tx to allow refurbishment work, reduced losses.
- **MMTP/GNTL – ISD 2020**
- 500 kV ac – 370 mi
- Need – 883 MW export; 698 MW import; 383 MW firm power sale, increased import improves drought resilience
- **Birtle-Tantallon – ISD 2021**
- 230 kV ac – 50 mi
- Need – 100 MW firm power sale, reduces GHG, allows for coal retirement in Sask.

https://www.manitobahydropower.com/who-we-are/

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Sources

- Pan Canadian Wind 2008 – https://canwea.ca/wind-integration-study/full-report/
- RECSI 2018 - https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/clean/RECSI_WR-SPM_eng.pdf
- NERC LTRA 2019 - https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2019.pdf
- Renewable and Resilience Issues - https://www.scottmadden.com/wp-content/uploads/2020/01/ScottMadden_WIRES_Informing-the-Transmission-Discussion_0-Preface_2020_0115.pdf
- Grid Codes – “Trending Grid Codes, Standards and IEC Collaboration”, IEEE PES magazine, Nov/Dec 2019.
- CapX2050 http://www.capx2020.com/documents/CapX2050_TransmissionVisionReport_FINAL.pdf
- Canada Energy Future - https://www.cer-rec.gc.ca/nrg/ntgrtd/ftr/2019/index-eng.html

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